Heating Piping & Air Conditioning

SEPTEMBER 1955

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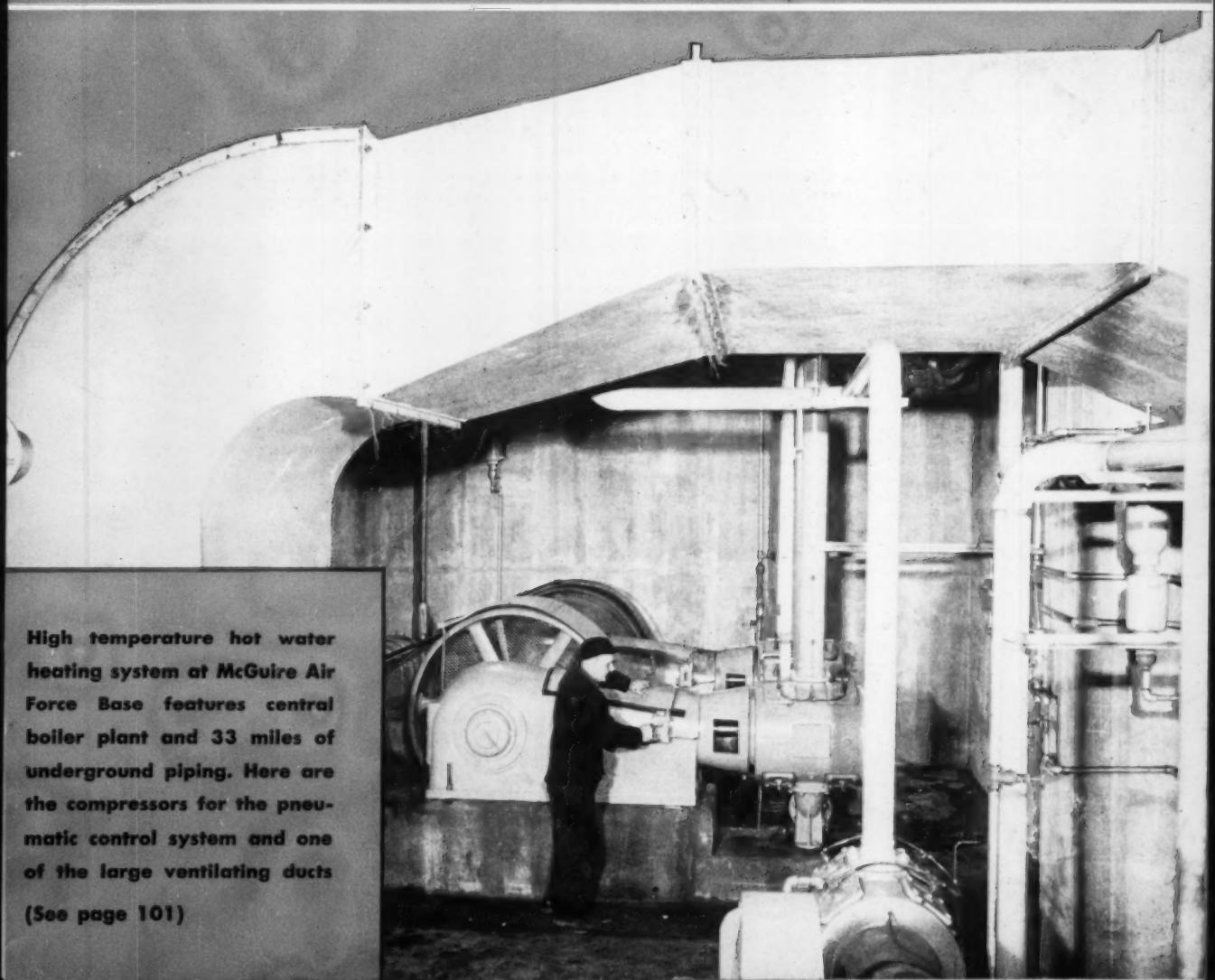
INDUSTRIAL • COMMERCIAL • INSTITUTIONAL • PUBLIC BUILDINGS

Journal Section of the American Society of Heating and Air-Conditioning Engineers—p. 137



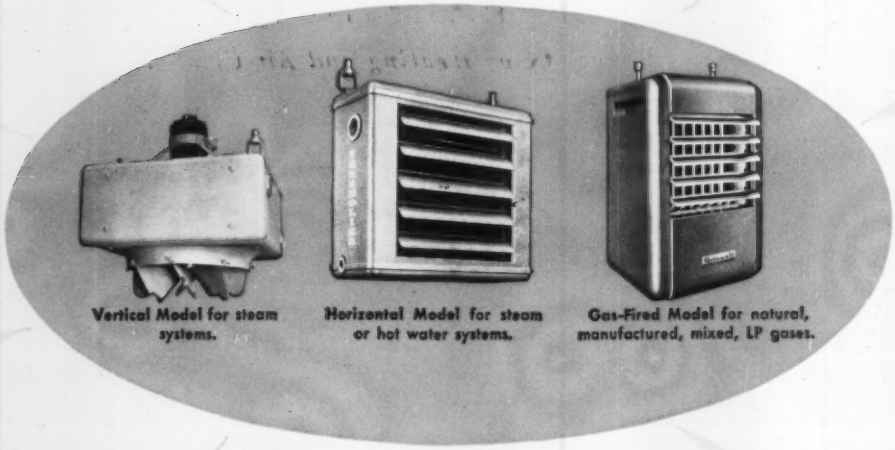
High temperature hot water heating system at McGuire Air Force Base features central boiler plant and 33 miles of underground piping. Here are the compressors for the pneumatic control system and one of the large ventilating ducts

(See page 101)

GRINNELL UNIT HEATERS

...for MAXIMUM comfort, economy, and flexibility

Grinnell Unit Heaters bring you many unique design and construction features, coupled with important advantages in comfort, economy, and ease of heating. Heat comes fast, even from a cold start — and is spread uniformly to all parts of the working area. It is not allowed to bank up uselessly under the ceiling. Units are compact. And, both unit and the simple piping are overhead, out of the way, easy to relocate if necessary. Heating capacity often exceeds that of other types costing twice as much.



Vertical Model for steam systems.

Horizontal Model for steam or hot water systems.

Gas-Fired Model for natural, manufactured, mixed, LP gases.

GRINNELL THERMOLIER
Steam/Hot Water Unit Heater
4 models . . . 18 sizes — from 35,600 to 275,300 total heat delivered, Btu per hour

Three basic models—horizontal, vertical, and a special horizontal Textile model. (Adjustable velocity nozzle also available for use on horizontal models.) All models have plain thermostatic trap, the simplest and least expensive kind of a trap, made practical because of unit's exclusive internal cooling leg; maximum capacity provided and destructive water hammer eliminated by built-in pitch of tubes. Many other important features.

GRINNELL
Gas-Fired Unit Heater
Available in 7 sizes — ranging from 25,000 to 200,000 Btu per hour input

Grinnell Gas-Fired Unit Heaters are easy to install, simple to operate and maintain. Efficient performance is assured — with any type of gas — by modern design of burners and heat exchanger, proper motor and fan unit. Automatic safety pilot operates to shut off main gas supply if pilot goes out. Flashback and extinction noise prevented by the burners' raised port design and proper port size for the gas used. American Gas Association approved.

Grinnell Unit Heaters are backed by over 60 years of heating experience, and proved by trouble-free service in countless installations. They are distributed by a coast-to-coast network of plumbing and heating jobbers . . . and in over 30 principal cities, Grinnell engineers can offer on-the-spot advice and help on your heating problems. For new buildings, or for modernizing existing heating systems, it makes good sense to call on Grinnell first — for the unit heater that will meet your specific needs.

AVAILABLE FROM YOUR LOCAL DISTRIBUTOR.

Grinnell Company, Inc., Providence, Rhode Island

Manufacturer of: pipe fittings • welding fittings • forged steel flanges • steel nipples • engineered pipe hangers and supports
Thermolier unit heaters • Grinnell-Saunders diaphragm valves • prefabricated piping • Grinnell automatic fire protection systems

usAIRco central station

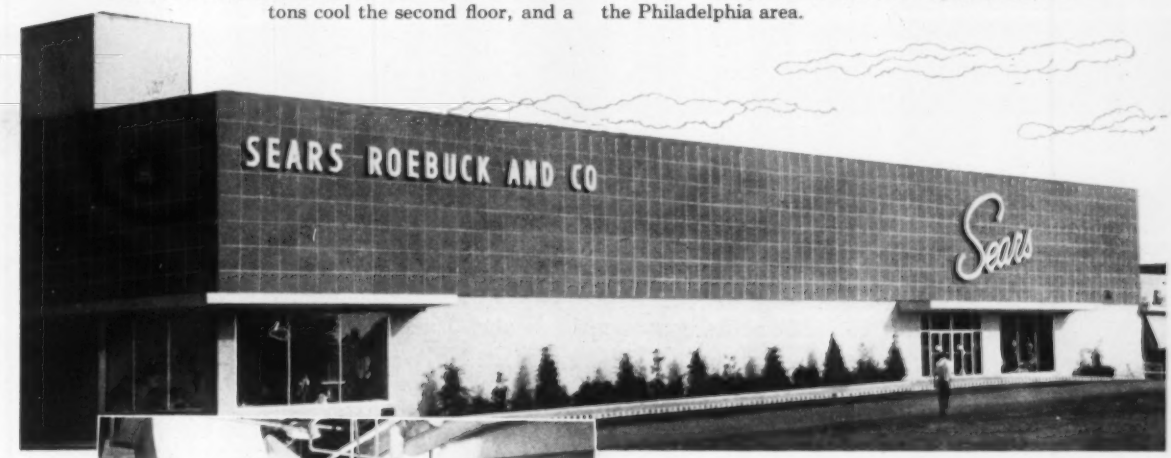
RK units cool and heat new windowless Sears store...

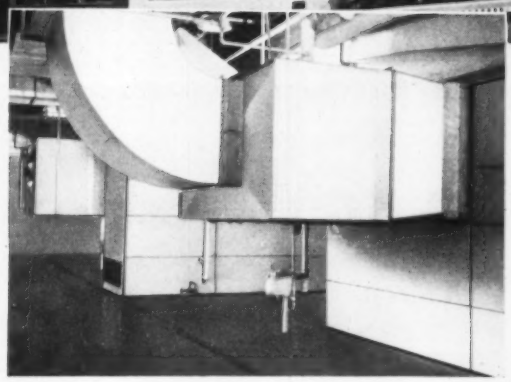
A 120-ton zoned year-round air conditioning system, utilizing 3 usAIRco RK self contained central station units, is now in operation in the new Sears, Roebuck & Company store in the Logan Square Shopping Center, Norristown, Pennsylvania. The 60,000 square foot, three-floor Sears building is the main unit of a 20-acre shopping center developed by Logan Square, Inc., owners, from plans by Herbert Anderson, architect. Three usAIRco RK units provide cooling, heating and ventilating for the windowless structure. A 50-ton RK serves the main floor, 40 tons cool the second floor, and a third unit, with 30 tons of cooling capacity, handles the basement.

All units are located in a second floor equipment room and are equipped with 1-row steam coils for winter heating. The system is designed to provide automatic heating-cooling changeover and to furnish 100 per cent fresh air for ventilation.

The system was installed by Clermont Engineering Co., Inc., heating and air conditioning contractor, the Irwin & Leighton Co. were the general contractors.

W. W. Malloy is the usAIRco representative in the Philadelphia area.





Three units provide 3-zone system located in second floor equipment room

The usAIRco RK equipment contains all of the elements of a central air conditioning plant, including built-in evaporative condenser in a single casing. All vital components of each unit are enclosed in an assembly for maximum compactness, allowing ample room for access in the equipment room. Steam coils provide winter heating.

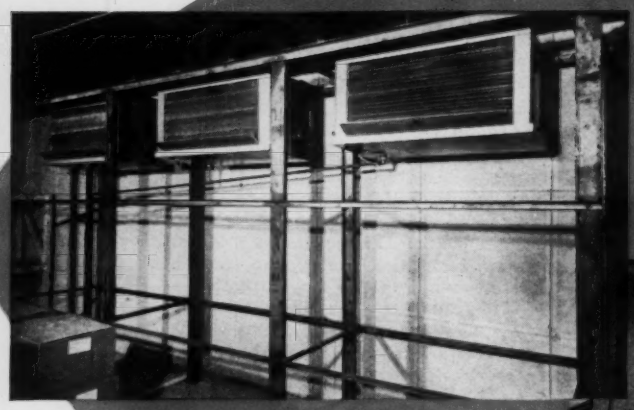
For descriptive literature, write R. G. McLain

UNITED STATES AIR CONDITIONING CORPORATION

MINNEAPOLIS 14, MINNESOTA. *Export: 13 E. 49th Street, New York 16, N. Y.*

usAIRco 30 YEARS OF AIR CONDITIONING

BUSH HG UNITS CHOSEN TO CHILL NEW FROZEN FOOD WAREHOUSE

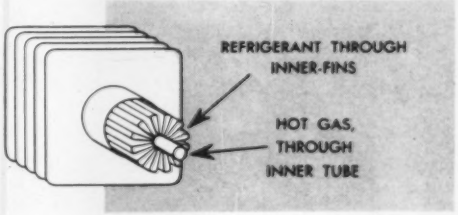


Bush 'HG' Hot Gas Defrost Unit Coolers refrigerate both the main storage area and "pickup" room of this modern Associated Grocers' frozen food warehouse in Pittsburgh.

Each 'HG' unit cooler is actually *two units in one.* Inner-Fin coil design—exclusive with Bush — combines evaporator and re-evaporator in a single unit. No reboilers, storage tanks or other complicated "extras" are required.

Units defrost *from the inside.* Inner-Fin design assures rapid distribution of heat to the area where frost forms. Thus, defrosting is quick and complete . . . room temperature rise is held to a minimum.

Write for catalog #835 containing complete information on new Bush line of low temperature equipment.



BUSH

BUSH MANUFACTURING COMPANY • West Hartford 10, Connecticut

RIVERSIDE • CALIFORNIA

Heating Piping & Air Conditioning

Vol. 27 No. 9

(with which is merged the Aerologist)

DESIGN, INSTALLATION, OPERATION AND MAINTENANCE IN INDUSTRIAL, COMMERCIAL, INSTITUTIONAL AND PUBLIC BUILDINGS

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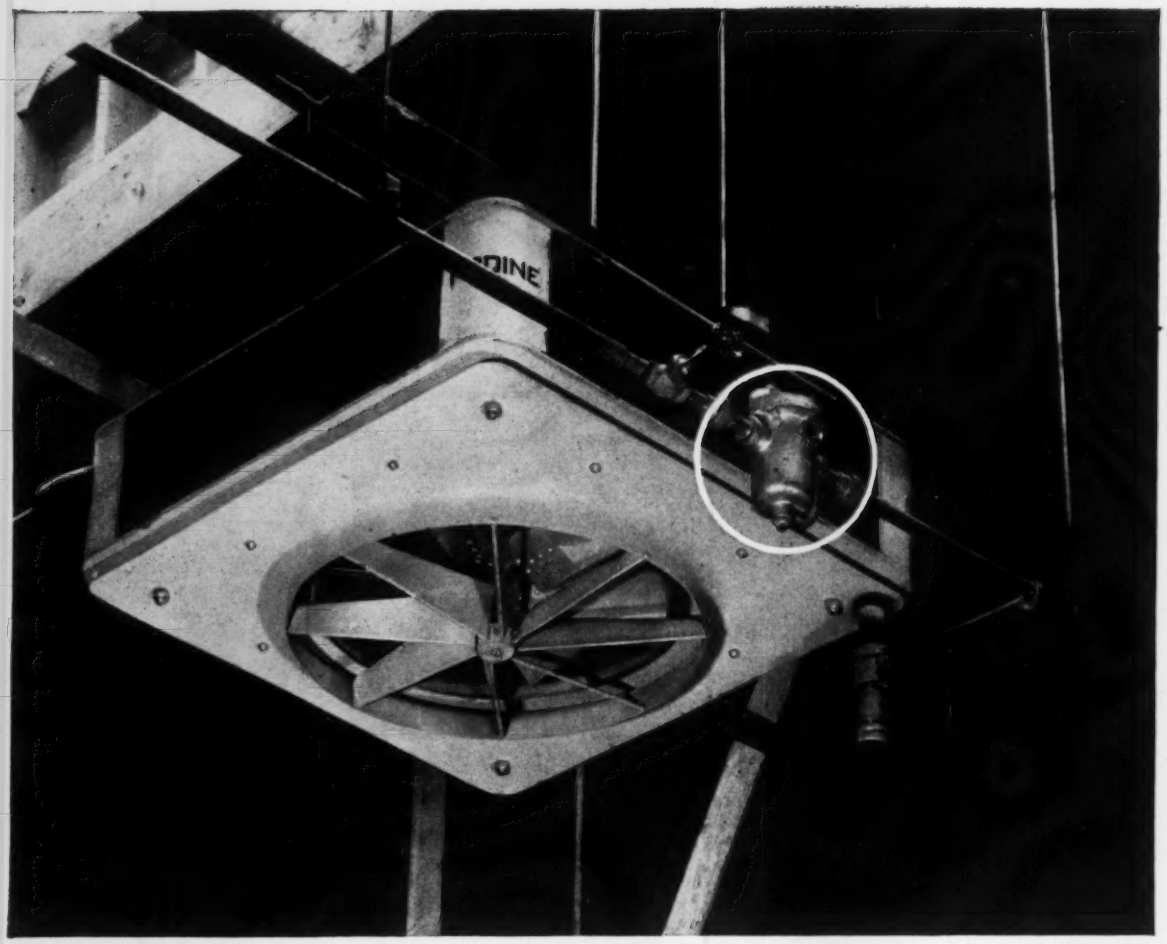
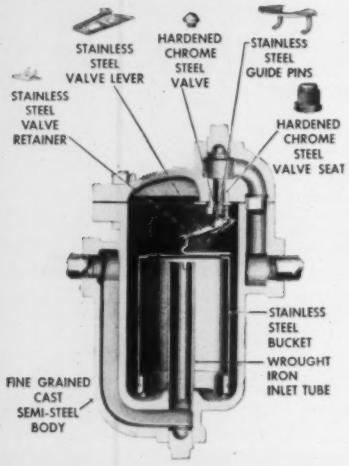


How Corrosion of Unit Heaters is Prevented by Good Trapping


STAINLESS STEEL VALVE LEVER
HARDENED CHROME STEEL VALVE
STAINLESS STEEL GUIDE PINS
STAINLESS STEEL VALVE RETAINER
HARDENED CHROME STEEL VALVE SEAT
STAINLESS STEEL BUCKET
WROUGHT IRON INLET TUBE
FINE GRAINED CAST SEMI-STEEL BODY

Good Traps. The mechanisms in Armstrong traps for unit heaters are substantially identical in design, workmanship and materials to those used in traps for 900 lbs. pressure, 900 degrees F.

Cause. Costly corrosion of unit heaters is frequently the result of sluggish condensate drainage and inadequate venting. Any carbon dioxide gas present in the steam supply will go into solution if the condensate is below steam temperature, forming corrosive carbonic acid. Presence of oxygen aggravates the corrosion.

Remedy. Armstrong traps prevent carbonic acid formation because they discharge condensate *at steam temperature* and vent CO_2 and air at the same time. There is never any accumulation of condensate and incondensible gases to cause trouble as can occur with traps that must wait for condensate to cool before they will open.

Trap Selection. It is important that the traps be correctly sized, with a generous safety factor to provide adequate air handling capacity. Armstrong sizing recommedations are thoroughly reliable, being based on actual performance of the traps under operating conditions rather than on theoretical considerations.

Complete Details. Ask for Armstrong Bulletin No. 2312 which tells how to select and install traps for any type of unit heater. For your free copy, call your local Armstrong Factory Representative, or write:

ARMSTRONG MACHINE WORKS
874 Maple Street, Three Rivers, Michigan

ARMSTRONG STEAM TRAPS *Application Engineered*

HERE'S THE SEQUEL TO "...or equal"

Standard 2" FAR-AIR Panel Filter.

Send for your copy showing complete specifications on the FAR-AIR line of quality filters.

When you see this specification..."FAR-AIR® filters or equal" remember that these filters *have no equal.* Substitutes mean contributions to the junk pile and higher eventual costs, so it pays to install the finest—FAR-AIR.

In FAR-AIR you get filters that handle more air with greater efficiency. Because of their greater dirt-holding capacity, you save up to 60% in maintenance. The "lifetime engineering" of FAR-AIR filters with their heavier frames, reinforcing rods and other features, insures that each unit will continue to operate with replacements virtually eliminated.

Yes, you'll want to use FAR-AIR filters eventually, so why not install them initially. Write for complete catalog information to FARR COMPANY, P.O. Box 45187, Airport Station, Los Angeles 45, California.

ORIGINATORS OF FAR-AIR CERTIFIED FILTER SERVICE

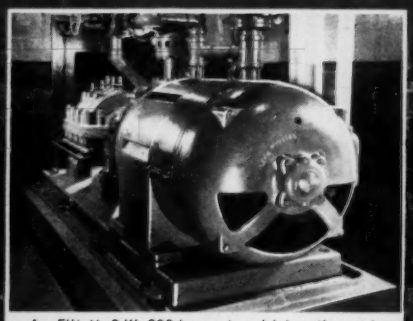
FARR COMPANY

NO COMPROMISE ON QUALITY

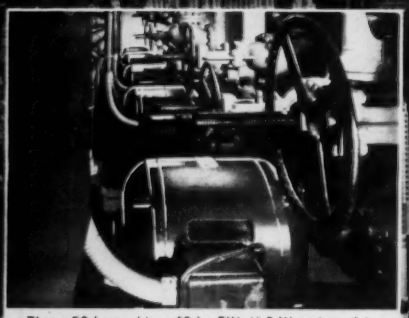
Los Angeles, New York, Chicago
New Orleans

MANUFACTURED UNDER LICENSE BY FARR COMPANY MANUFACTURING LTD. MONTREAL, CANADA

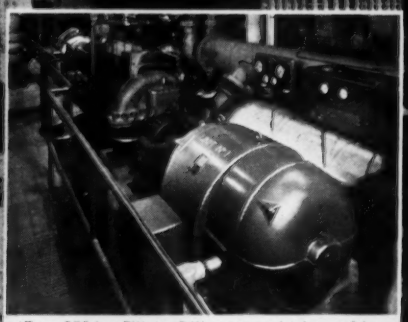
Bringing man-made coolness



An Elliott C-W 200-hp motor driving the main fire pump in a large New York skyscraper.

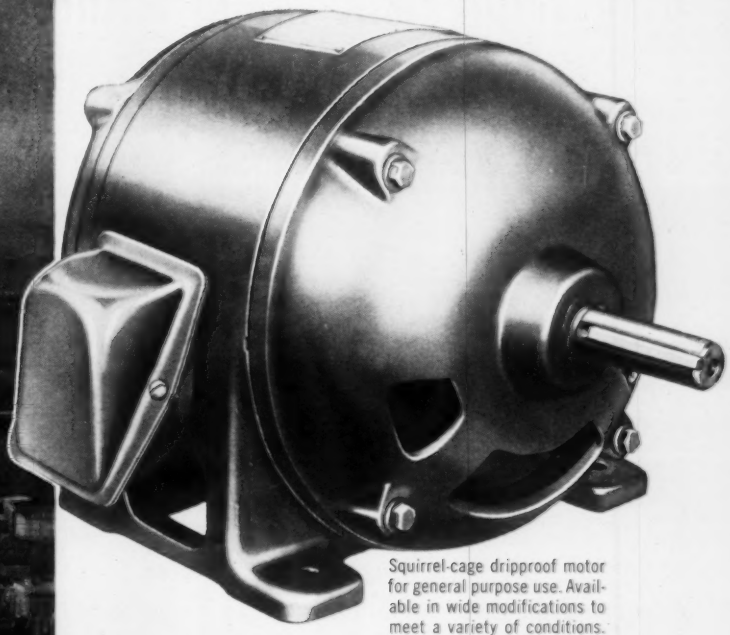


Three 50-hp and two 40-hp Elliott C-W motors driving pumps in a famous New York office building.

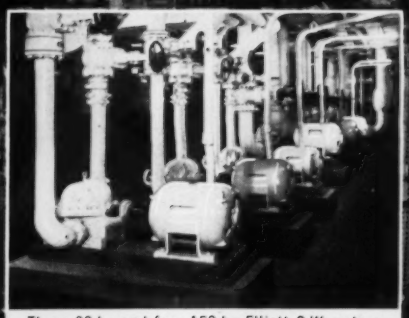


Two 350-hp Elliott C-W motors driving refrigeration compressors at a New York building.

to the city...



Squirrel-cage dripproof motor for general purpose use. Available in wide modifications to meet a variety of conditions.



Three 60-hp and four 150-hp Elliott C-W motors driving pumps in an attractive New York hotel.

Photo from Fairchild Aerial Surveys, Inc.

ELLIOTT
CROCKER-WHEELER
MOTORS

● Backed by over sixty years of proven design and construction, these rugged motors are favored for the big air conditioning jobs in city after city throughout the country. In New York City, for example, Elliott C-W motors are serving modern buildings such as: The Waldorf-Astoria, Lever House, Dun & Bradstreet, U. S. Steel and The United Nations, to name just a few.

In addition to air-conditioning drives, reliable Elliott motors are used in large numbers for driving fire pumps, sump pumps, fans, sewage ejector pumps, and other auxiliary service equipment. For detailed information call your local Elliott representative, or write Elliott Company, Crocker-Wheeler Division, Jeannette, Pa.

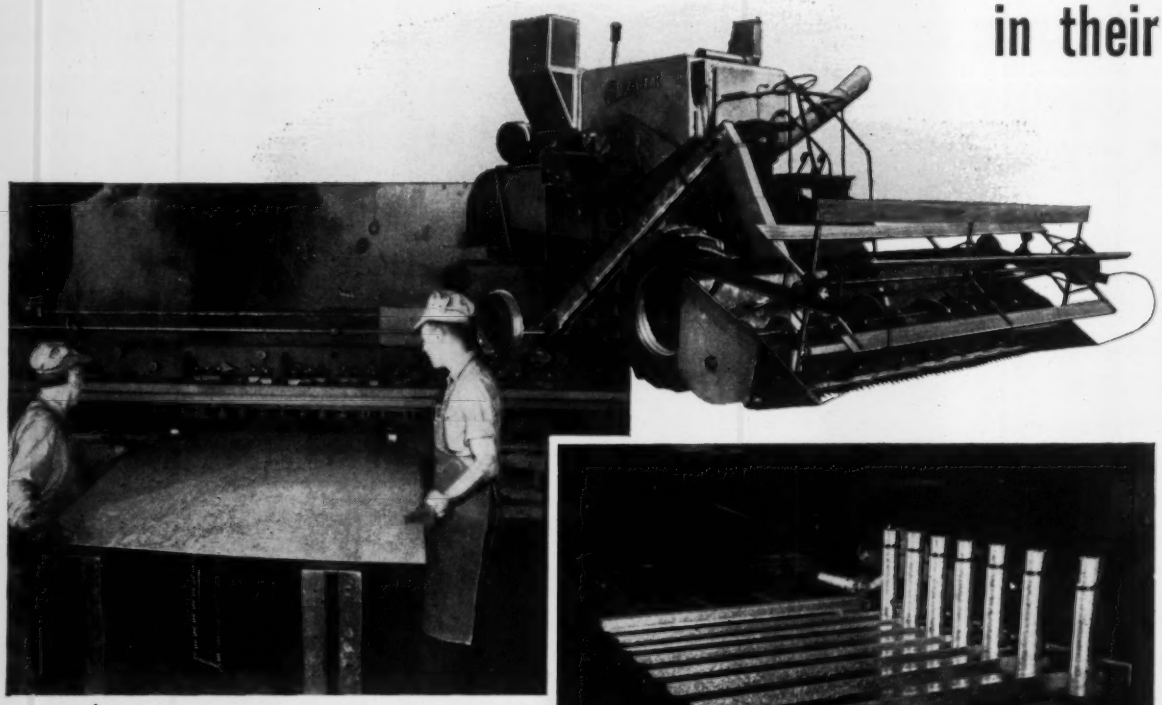
ELLIOTT Company

STEAM TURBINES • MOTORS • GENERATORS • DEAERATING HEATERS • EJECTORS
CONDENSERS • CENTRIFUGAL COMPRESSORS • TURBOCHARGERS • TUBE CLEANERS • STRAINERS

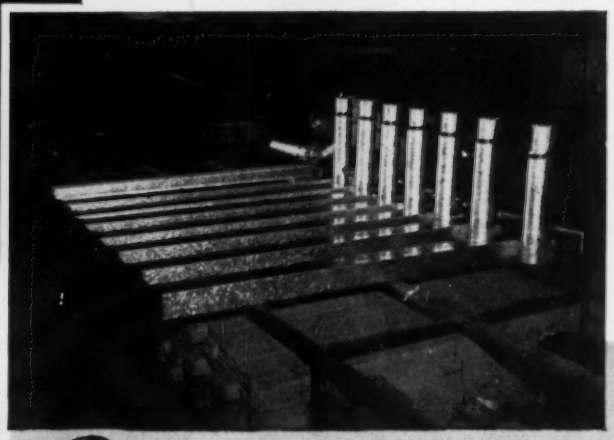
WS-10

Leading Implement Manufacturer utilizes the quality features of

in their



An early processing step demonstrates the die punching of assembly holes in the USS Galvanized Steel Sheet that will later become grain bin bottom.



Another operation shows the assembly of grain bin elevators. The formed sheets are soldered to make them grain tight, then riveted for strength.

Here the rigid frame is riveted to the grain bin.

SEE "THE UNITED STATES STEEL HOUR"—Televised alternate weeks—Consult your newspaper for time and station.

USS Galvanized Steel Sheets

Gleaner Baldwin Combine

The 1955 Allis-Chalmers line of well-known Gleaner Baldwin Self-Propelled Combines is an outstanding example of the use of USS Galvanized Sheets to assure a quality product.

Allis-Chalmers explains in their advertising literature why they use Galvanized Steel Sheets:

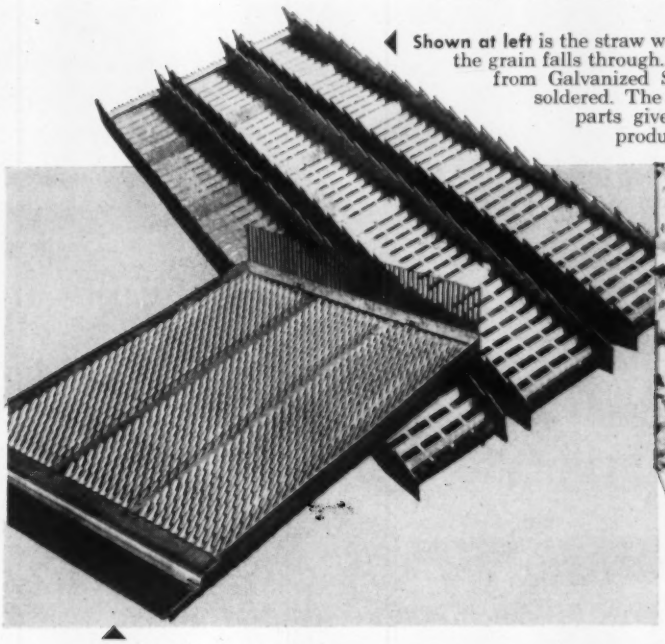
"Galvanized sheet steel is used throughout the Gleaner Baldwin. These corrosion-proof sheets which require no painting give you the protection needed for the life of the combine. After many years of exposure galvanized sheets will not rust or deteriorate materially. The grain bin, the separator, the shoe and the elevators are made of galvanized sheet steel. This extra quality is part of the premium you get with a Gleaner Baldwin."

In addition to their long-wearing properties, USS Galvanized Steel Sheets have other advantages. They allow Allis-Chalmers to offer the farmer a good-looking combine that will stay that way without any painting or special maintenance — an important sales point.

Another outstanding quality of USS Galvanized Steel Sheets is their workability. In the pictures some examples are given of the many shearing, blanking, punching, notching, cutting, forming, stamping, bending, twisting, drawing, beading, seaming, riveting, welding, screwing, and soldering steps to which these sheets are subjected. The fact that USS Galvanized Steel Sheets stand up under these severe fabricating operations, without failure or flaking, is proof of their superior workability, ductility and uniform quality.

If there's a place in *your* operation where the top-quality of USS Galvanized Steel Sheets will pay off, ask your sheet distributor or our nearest district sales office or write for more information to United States Steel Corporation, 525 William Penn Place, Pittsburgh 30, Pa.

UNITED STATES STEEL CORPORATION, PITTSBURGH • COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO
TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA. • UNITED STATES STEEL SUPPLY DIVISION, WAREHOUSE DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK



Shown at left is the straw walker, which moves the straw up the incline while the grain falls through. All these intricate parts are stamped and formed from Galvanized Steel Sheets, then screwed, riveted, welded and soldered. The straw walker takes a real beating. All of these parts give the best service when formed from a quality product like USS Galvanized Steel Sheets.

Shown above is the chaffer, the heart of the combine, where the grain is separated from the chaff. All these moving, vibrating teeth are made from USS Galvanized Steel Sheets. For this application, the galvanized steel must not only be uniformly ductile and non-flaking, but must also be absolutely non-rusting.

USS GALVANIZED STEEL SHEETS

UNITED STATES STEEL

Ultra-modern Sears retail store shows how you can provide

Indoor weather to satisfy your most progressive client

Specify Honeywell Customized Temperature Control—most important comfort feature any building can have

Comfortable shopping atmosphere for customers, efficient working conditions for employees—these are of vital concern in the retail stores of Sears, Roebuck and Company's world-wide merchandising organization.

Small wonder, then, that a Honeywell Customized Temperature Control installation was specified for the new, completely air conditioned Sears store in Oklahoma City. For this is the truly *modern* way to ensure ideal indoor weather, no matter how varied a building's functions may be.

"Customized" is the key word here. Because it means that a Honeywell Customized Temperature Control installation is designed to fit the needs of the building and its occupants—in heating and cooling, in ventilating and humidity control.

Only Honeywell can provide true "customized" control. Because only Honeywell manufactures all three types of controls—pneumatic, electric and electronic.

The comfort story of the new Sears store is told briefly by the floor plan and picture captions. The *techniques* used, applied to your specific problems of occupancy, use and exposure, can help you to provide your most progressive clients with the kind of ideal indoor weather they need.

Individual temperature control is an important benefit enjoyed by occupants of Sears' executive offices. Adjustments may be made quickly to meet exact personal requirements. The result is an environment of ideal comfort that encourages maximum efficiency—an advantage made possible *economically* by the Honeywell Customized Temperature Control installation.

Few walls are visible in Sears' main shopping areas. Large open spaces create one temperature control problem; customers, in numbers that vary from hour to hour and day to day, create another. Both are solved by the Honeywell Customized Temperature Control installation, with its accurate thermostats that respond quickly to occupancy variations.

Thirteen zones, each precisely controlled by Honeywell thermostats, are employed in heating and cooling Sears' Oklahoma City store. Plan detail below shows ground floor thermostat locations. Strategically placed, they compensate for changing factors of occupancy and exposure so that comfort levels are held constant. Called for here was a comfort control installation as advanced as the building itself: Honeywell Customized Temperature Control.

Architects-Engineers: Sorey, Hill & Sorey; J. E. Redden, Chief Architect, Sears, Roebuck & Co.; General Contractors: Manhattan Construction Co.; Mechanical Contractor: W. A. Landers Co.

For comfortable, more productive temperature in new or existing buildings —of any size—specify Honeywell Customized Temperature Control

Whether it's a store, factory, hospital, bank—any building of any size, new or existing—Honeywell Customized Temperature Control can help solve your clients' problems of heating, ventilating, air conditioning and industrial control. At the same time you can give them more comfort, more efficiency, more economy.

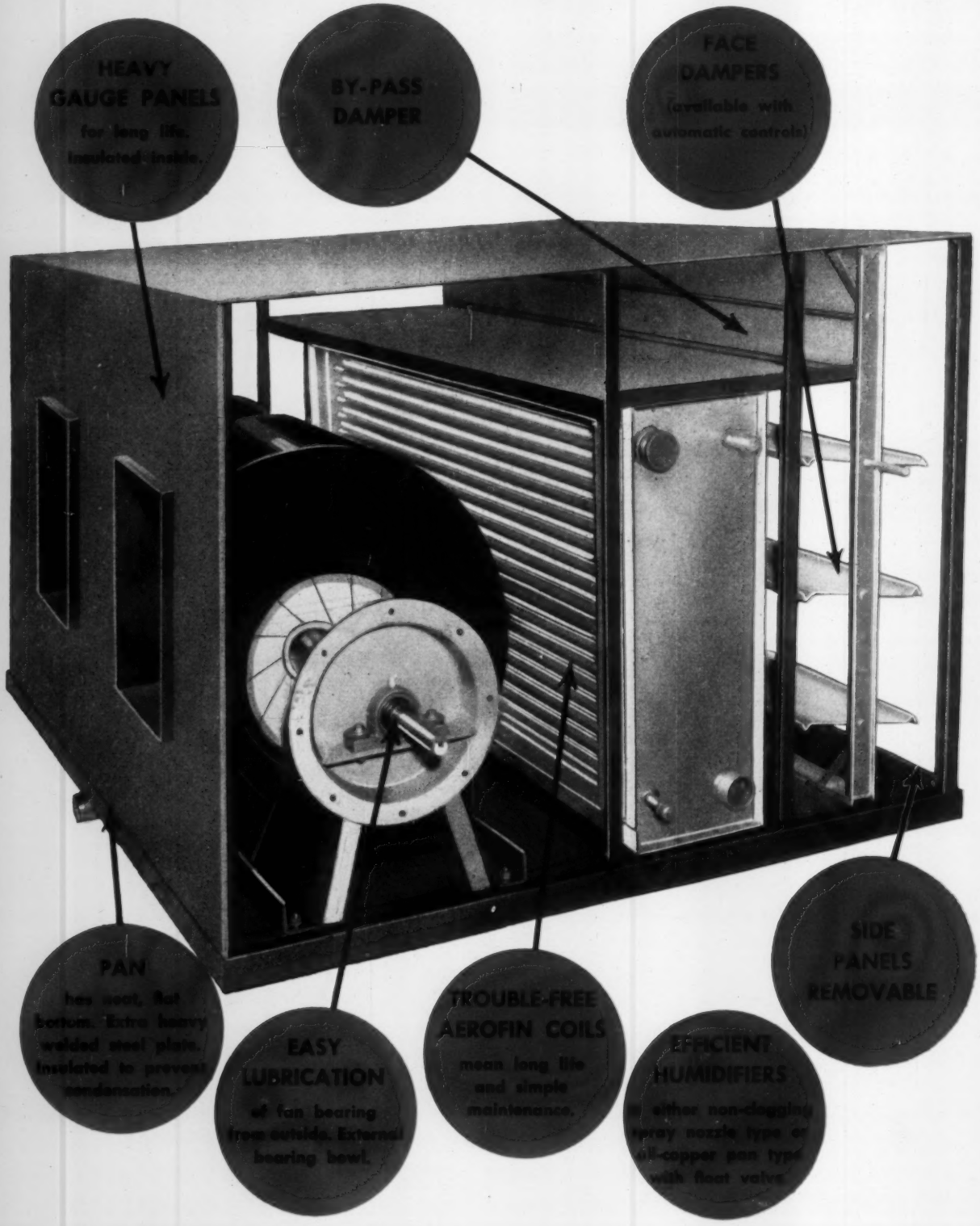
For full details on Honeywell Customized Temperature Control, and the economical Periodic Maintenance Plan, call your local Honeywell office. Or write Honeywell, Dept. HA-9-132, Minneapolis 8, Minnesota.

MINNEAPOLIS **Honeywell**

Customized Temperature Control

112 offices across the nation

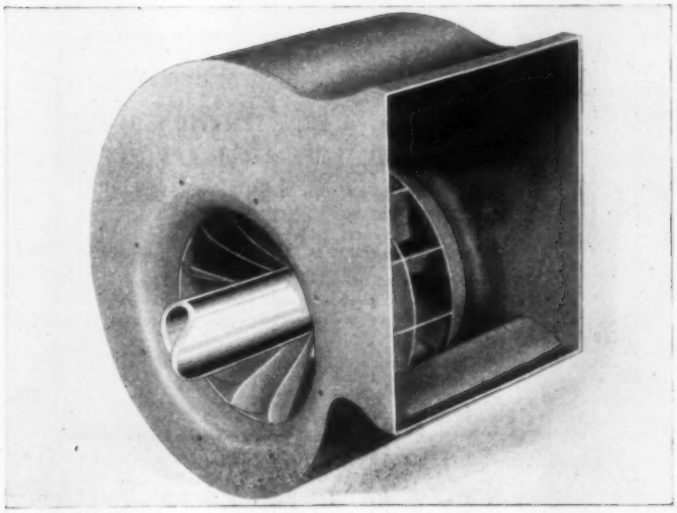
"Buffalo" AIR CONDITIONING


HEAVY GAUGE PANELS
for long life. Insulated inside.
BY-PASS DAMPER
FACE DAMPERS
(available with automatic controls)
PAN
has soot, flat bottom. Extra heavy welded steel plate. Insulated to prevent condensation.
EASY LUBRICATION
of fan bearing from outside. External bearing bowl.
TROUBLE-FREE AEROFIN COILS
mean long life and simple maintenance.
EFFICIENT HUMIDIFIERS
in either non-clogging spray nozzle type or all-copper pan type with float valve.
SIDE PANELS REMOVABLE

CABINETS ARE BUILT TO STAY SOLD!

This view of a "Buffalo" PC Cabinet (with side panels removed) shows why these units give *lasting satisfaction on the job.* It's part of what we call the "Buffalo" "Q" Factor*. From filter box to outlet, construction is both heavy-duty and convenient for maintenance. You'll like their ease of installation, too — this horizontal PC Cabinet can be placed directly on the floor or suspended. And where space is short, use "Buffalo" VPC Cabinets. These vertical models are in three demountable sections for moving in thru standard building openings. All models available with air washer sections, too, if desired. Capacities from 875 to 22,000 cfm. *Bulletin 3703A* gives full details. Write for your copy!

**The "Q" Factor — the built-in Quality which provides trouble-free satisfaction and long life.*



STABLE, EFFICIENT, QUIET DELIVERY

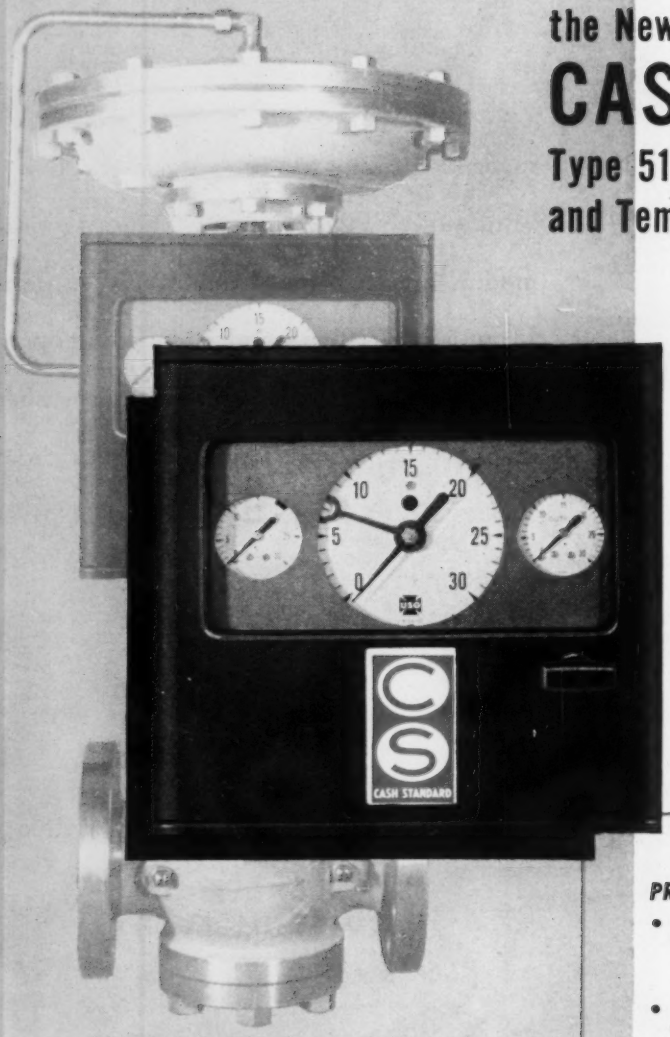
with "Buffalo" mixed-flow fans — much more efficient than forward curve wheels and can be operated at higher pressures and speeds at lower noise level.

BUFFALO FORGE COMPANY
171 MORTIMER ST. BUFFALO, N.Y.
PUBLISHERS OF "FAN ENGINEERING" HANDBOOK
Canadian Blower & Forge Co., Ltd., Kitchener, Ont.
Sales Representatives in all Principal Cities

"Buffalo"

VENTILATING AIR CLEANING AIR TEMPERING INDUCED DRAFT EXHAUSTING FORCED DRAFT COOLING HEATING PRESSURE BLOWING

PROVIDES PRECISE, DEPENDABLE CONTROL OF PRESSURE AND TEMPERATURE . . .



Cash Standard Type 51 Pilot can be ordered separately or mounted on a Cash Standard Control Valve (Illustration is one example).

the New CASH STANDARD

Type 51 Pressure Pilot and Temperature Pilot

- Process pressure or temperature gauge incorporated in the pilot
- Calibrated set point adjustment
- Unit construction
- Feedback proportional control—1 to 100% proportional band and differential gap
- Available with proportional, plus automatic reset action
- All-metal, frictionless power relay
- Sapphire nozzle feed orifice with push button cleaner

A WIDE SELECTION OF PRESSURE AND TEMPERATURE RANGES

- Pressure-sensing elements available in phospor bronze, beryllium copper or stainless steel

  Pressure ranges: 0-15 to 0-10,000 psi also 0-30" H_2O and 0-30" Hg vacuum

- Mercury-actuated armored capillary temperature-sensing element available with plain bulb, union connection or union connection with separable socket.

  Temperature ranges available from—40°F. to 1000°F.

WRITE TODAY for Bulletin 978-B containing complete information.

CASH STANDARD

A. W. CASH COMPANY, P. O. Box 551, Decatur, Illinois

Pressure, Hydraulic, Temperature, Process and Combustion Controls

Here's where you get the answers to pipe problems

●Look under "The Youngstown Sheet and Tube Company" in one of these alphabetical or classified phone books.

They represent the 28 conveniently located district sales offices Youngstown maintains across the country. Offices staffed by men who are specialists in steel and who know pipe. They understand **your** problems and are qualified to help you get the pipe you need.

If you aren't in touch now with a Youngstown pipe distributor, just call the Youngstown district office nearest you and we will help you solve your pipe problems.

QUALITY YOUNGSTOWN SERVICE

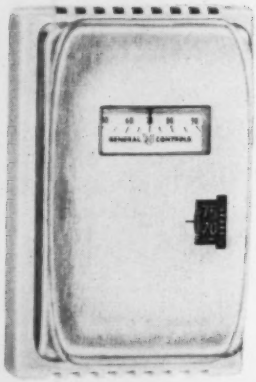
THE YOUNGSTOWN SHEET AND TUBE COMPANY *Manufacturers of Carbon, Alloy and Yoloy Steel*

General Offices Youngstown, Ohio District Sales Offices in Principal Cities.

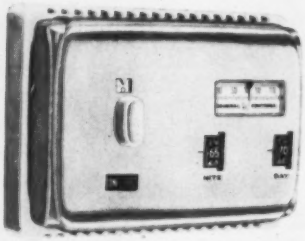
SHEETS - STRIP - PLATES - STANDARD PIPE - LINE PIPE - OIL COUNTRY TUBULAR GOODS - CONDUIT AND EMT - MECHANICAL TUBING - COLD FINISHED BARS - HOT ROLLED BARS - WIRE - HOT ROLLED RODS - COKE TIN PLATE - ELECTROLYTIC TIN PLATE - BLACK PLATE - RAILROAD TRACK SPIKES - MINE ROOF BOLTS

Now...General Controls

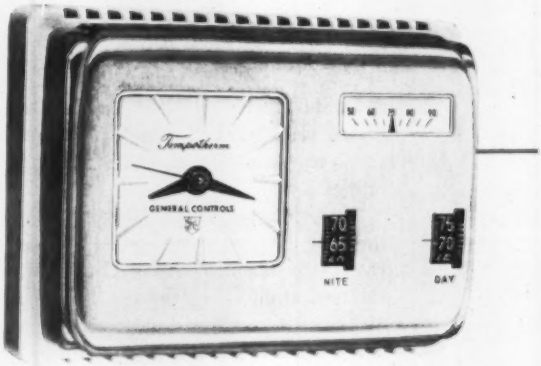
—with the original, whisper-quiet B-50 diaphragm valve



T-70 Standard Thermostat . . . quick response, snap action type with flush-set roller dial. Built-in heat anticipation. Stainless steel face plate eliminates "tell-tale" fingerprints.



T-265 Timer Thermostat . . . automatically switches from night level to day level after expiration of selected interval which is manually set by a spring-type timer.

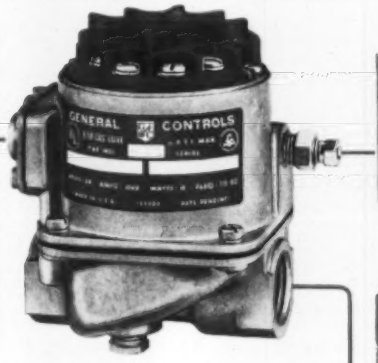


T-270 Tempotherm . . . combination clock thermostat which switches from day to night temperatures absolutely automatically. Set it once like a clock —then forget it. The thermostat does the rest.

Every one of these important B-50 components has established itself in its particular field as an outstanding performer. Each has been selected time and again for inclusion in a control system as an outstanding sales feature—a guarantee of dependability, accuracy, and efficiency. With such a record of individual stars, these outstanding components leave no doubt that, in combination, they are unbeatable. That's why a custom-matched General Controls thermostat, valve, limit, safety and pilot indeed constitute a "dream team" for the ideal 24-volt gas heating control system.

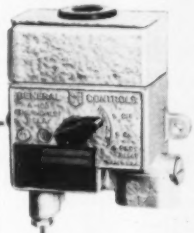
offers you the world's most efficient 24-volt gas control system!

These famous matched components provide dependability, straight-line temperature control, and quiet operation for forced air heating systems.

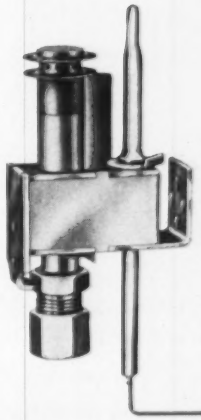


Whisper-Quiet B-50 Electric Diaphragm Valve . . . the industry's most compact, highest capacity, diaphragm gas valve. Pioneered by General Controls, the B-50 has proved its dependability over the years by an outstanding service record. Available in all standard sizes and capacities for all gases including LPG, sour, and scrubbed coke gas.

L-44 Fan and Limit Control . . . newly developed, extra sensitive fan and limit control, with powerful S-shaped bimetal element. Multipoised, simple to install, mounts flush and requires no leveling.



A-100 Thermopilot Relay . . . single couple design with manual or automatic reset. Contacts open when pilot flame goes out, automatically close when it is restored. Also available in *100% safety shutoff* models.



260 Pilot Burner with 2600 Thermocouple . . . famous General Controls Snorkel design passes all primary air through pilot flame to incinerate dirt and lint, and maintain pilot efficiency.

General Controls

B-50

24-Volt Gas Control System

General Controls' *complete* 24-volt system is the strongest possible guarantee of lasting satisfaction. To the manufacturer, the B-50 means a better end product, enhanced by perfect control performance . . . to the dealer, a better product because General Controls' reliability insures against costly "call-backs."

A country-wide network of 40 factory branch offices stand ready to serve you. Consult the yellow pages for the one nearest you.

1916 YEARS 1955

1955 GOLDEN JUBILEE YEAR

GENERAL CONTROLS

MANUFACTURERS OF AUTOMATIC CONTROLS FOR HOME, INDUSTRY AND THE MILITARY

GENERAL CONTROLS • PERFEX CONTROLS

40 FACTORY BRANCH OFFICES SERVING THE UNITED STATES AND CANADA

FIVE PLANTS: IRON MOUNTAIN, MICHIGAN • GLENDALE, CALIFORNIA • BURBANK, CALIFORNIA • SKOKIE, ILLINOIS • GUELPH, CANADA

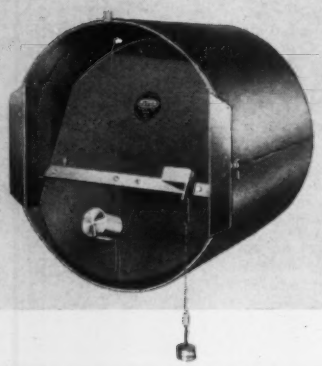
DEPENDABLE,

PRECISELY ACCURATE

Draft Control

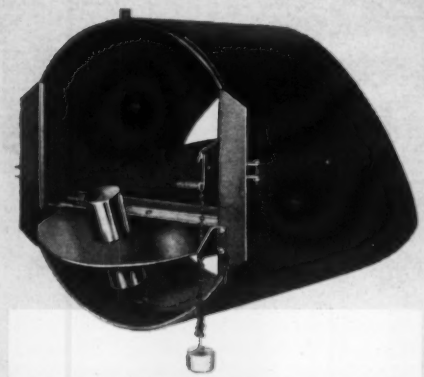
for coal fired, oil fired, gas fired or gas-oil fired

HEATING PLANTS



FIELD TYPE "M" for coal and oil fired heating plants

Heavy duty commercial model in 28" and 32" sizes. Heavy, rigid construction assures long, trouble free service. Stainless steel knife edge bearing for permanent sensitivity. Also available in 6" through 24" sizes for domestic and commercial installations. First choice of heating men — the round control you can level on any flue.



FIELD TYPE "MG" for gas and gas-oil fired heating plants

A heavy duty, precision built control in sizes 8" through 32" for commercial and industrial installations. Stainless steel knife edge bearings for permanent sensitivity. Gate opens inward to regulate updrafts, and outward to relieve down-drafts. Optional safety switch available where codes require. Fully proven, accepted virtually everywhere.

They're real HEAVYWEIGHTS

Compare the weight of a Field Control to any other available. Here is proof of the massive, welded construction, long, vibration-free service, that permits Field's supreme accuracy.

Size Control	Gate	Thickness of Parts Side Plates	Ring	Collar	Wt. without Crtn. or Crate
14 M	16 Ga.	16 Ga.	⅝ x 2"	22 Ga. Galv.	19 #
16 M&MG	16 Ga.	16 Ga.	⅝ x 2"	18 Ga. Galv.	28 #
18 M	16 Ga.	16 Ga.	⅝ x 2"	18 Ga. Galv.	35 #
20 M&MG	16 Ga.	16 Ga.	¼ x 2"	18 Ga. Galv.	41 #
24 M&MG	14 Ga.	16 Ga.	¼ x 2"	18 Ga. Galv.	65 #
28 M&MG	14 Ga.	14 Ga.	¼ x 4"	14 Ga. H.R.S.	110 #
32 M&MG	14 Ga.	14 Ga.	¼ x 4"	14 Ga. H.R.S.	140 #

field

FIELD CONTROL DIVISION

of H. D. CONKEY & COMPANY, Mendota, Ill.

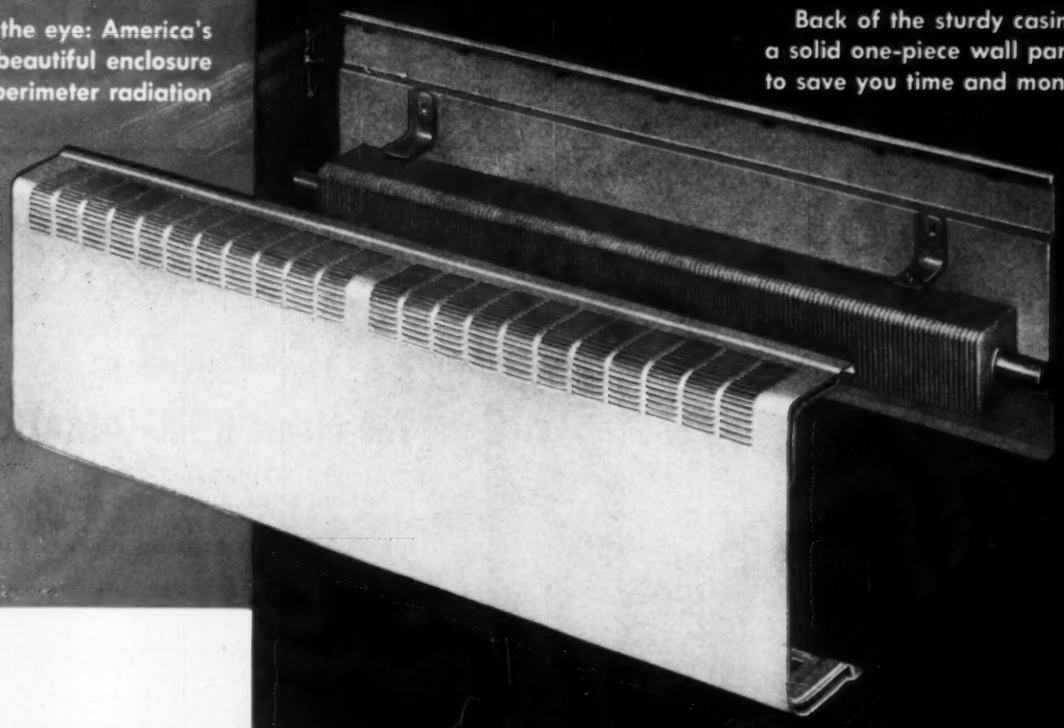
Affiliates

Conco Building Products, Inc. • Brick, Tile, Stone
Conco Materials Handling Division • Cranes, Hoists

Sill-line: Beauty backed by VALUE

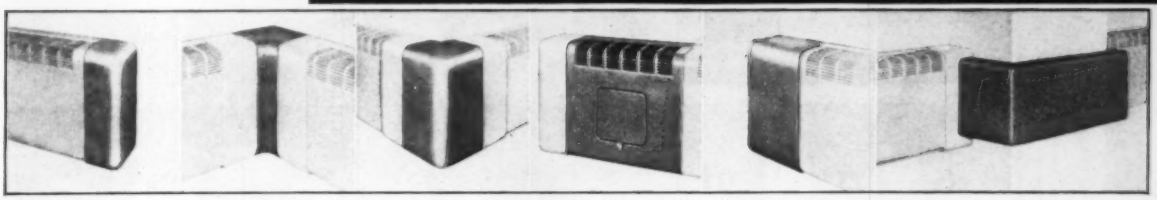
To the eye: America's most beautiful enclosure for perimeter radiation

Back of the sturdy casing: a solid one-piece wall panel to save you time and money



Built up to a standard, not down to a price

The heavier 16-gauge enclosure finished in baked enamel will forever remind you of its beauty and endurance. The standard one-piece back panel that covers raw walls and insures quick, rigid, true-alined installation more than pays its way in savings of time and face material.



Most for the dollar

Nesbitt Sill-line Radiation is today's best buy in perimeter heating. It offers the most beauty, comfort and convenience for the dollar. For use with steam or hot water; capacities, 2.9 to 11.1 sq ft EDR. Five cabinet types; seven lengths of casing and element from 2′ to 8′. Complete accessories and sleeves—no cutting on the site.

Insist on Nesbitt

Make sure you get all the features Nesbitt Sill-line offers: one-piece back panel, sturdy 16-gauge enclosure, baked enamel finish, and a full range of matching accessories. Send for Publication 102.

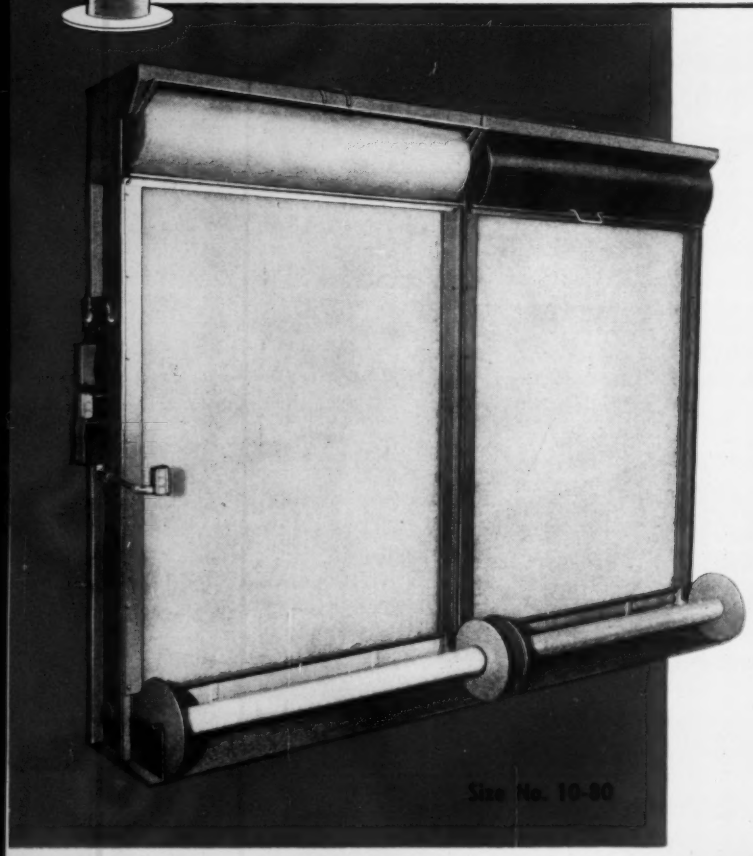
Nesbitt Baseboard Radiation
Ask for Publication 272

Nesbitt Convectors
Publication 262

Gas-fired Unit Heaters
Publication 280

Nesbitt
Sill-line Radiation
is manufactured and sold by
John J. Nesbitt, Inc., Phila. 36, Pa.

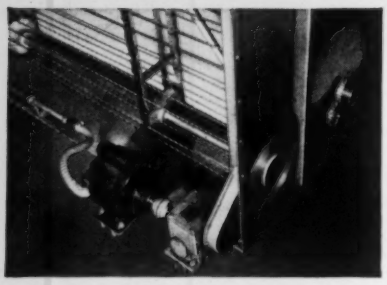
Clean Air by the



The magic ROLL-O-MATIC!

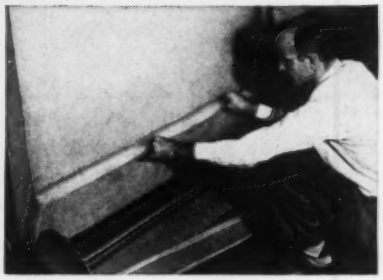
Front view of automatic self-cleaning air filter consisting of two 5′0″ wide by 8′0″ high sections having a total capacity of 26,700 cfm. The renewable media filtering curtain, mounted in roll form at top of each section, moves down the face of the filter and is re-rolled at bottom.

AAF
herman nelson



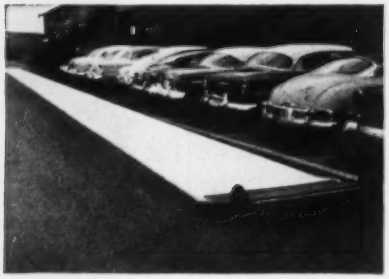
YOUR MAINTENANCE MAN IS A MOTOR!

Controlled by an automatic time switch, this single motor supplies the power for both introducing sufficient clean media to maintain desired operating resistance and for re-winding the dirt laden material.



READY TO ROLL!

Free end of fiber glass filtering curtain is attached to driven spool at bottom of filter which re-rolls the used material for later disposal. Note thickness of material in the filter curtain.

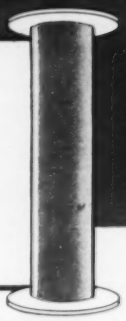


A YEAR'S SUPPLY OF CLEAN AIR!

Pictured is a standard 70 ft. length of filtering material for a 5 ft. wide ROLL-O-MATIC section. When rolled on spool, it forms a compact, easy-to-handle package only 13″ in diameter.

B E T T E R A I R I S O U R

ROLL!



Roll-O-MATIC

writes a new chapter in maintenance-free, low cost air filter operation

Once-a-year air filter maintenance is no longer a "dream". ROLL-O-MATIC makes it a reality with the renewable media filtering curtain supplied in roll form.

This is no ordinary filtering curtain. It's a "blanket" of bonded glass fibers possessing the high cleaning efficiency, dust holding capacity and velocity rating of a viscous filtering media. But, unlike such media, it is sufficiently resilient and flexible to permit packaging 70 ft. lengths in compact 13″ diameter rolls.

Equipped with this versatile media, ROLL-O-MATICS are setting new high standards for maintenance-free operation—a fact verified by field reports which indicate that a single roll of this low cost material represents a *year's supply* per 18,000 cfm capacity under normal operating conditions. This means that, in addition to the man-hours saved through reduced maintenance, ROLL-O-MATICS are operating at less than half the cost of disposable type filters of equal capacity.

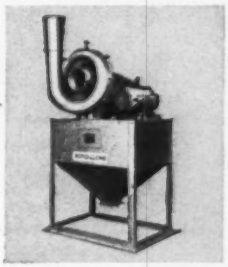
"Clean air by the roll" is the most significant air filter development of the past decade. For complete technical data on the ROLL-O-MATIC, call your local AAF representative, now, or write for Bulletin No. 248.

American Air Filter
COMPANY, INC.

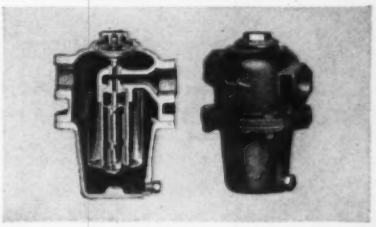
373 Central Avenue, Louisville 8, Kentucky
American Air Filter of Canada, Ltd., Montreal, P. Q.

B U S I N E S S

OTHER AAF herman nelson PRODUCTS

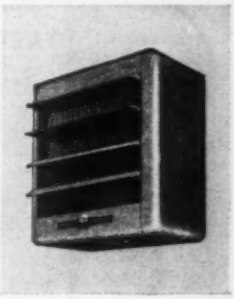


AAF Type D ROTO-CLONE—designed for the dry collection of granular dust. One of five basic types in AAF's complete line of dust control equipment. Ask for Bulletin 270.



illinois Float and Thermostatic Traps—made in three series for operating ranges from 50 pounds pressure to 25 inches vacuum. Ask for Bulletin 27.

herman nelson propeller-fan type unit heaters for use with steam, hot water or gas. Ask for Bulletins 700 and 715.



American Air Filter Company, Inc.
373 Central Avenue, Louisville 8, Ky.

I would appreciate receiving catalogs describing the following equipment—

- ☐ *Roll-O-MATIC* Air Filters (248)
- ☐ **ROTO-CLONE** Dust Control Units (270)
- ☐ **illinois** Traps (27)
- ☐ *herman nelson* Unit Heaters (700-715)

Name_____

Company_____

Street_____

City_____ State_____

Matchless Beauty and Performance In Heating and Cooling

Lima

MATCHED

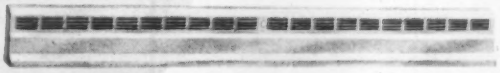
PERIMETER BASEBOARD LINE

HERE — at competitive price — is the finest, most beautiful line of *matched* baseboard units you can install for heating and cooling in new houses and modernization jobs.

All Lima baseboard diffusers and return air grilles have horizontal louvers which harmonize perfectly with the horizontal lines of baseboard, window and floor. All units have the same permanent medium beige finish which saves repainting cost unless requested by the customer. And all Lima baseboards have exclusive features that reduce installation time and labor.

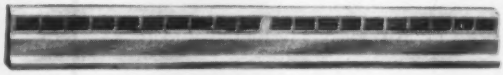
The performance is just as outstanding. The Lima Baseboard Diffuser assures efficient air diffusion spread evenly over a wide area regardless of velocity or damper setting. Reasonably high velocity and correct vertical angle induces recirculation of air within room for gentle, imperceptible air motion.

It costs no more to give your customers the matching beauty, extra sturdy construction and matchless performance of Lima Matched Baseboard Diffusers and Return Air Grilles. Ask your wholesaler or write direct for literature and prices.



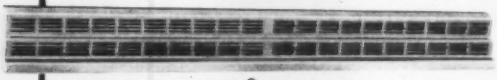
Series 70

DIFFUSER with rattle-free built-in automatic pushbutton damper.



Series 75

DIFFUSER without damper, for economy installations.

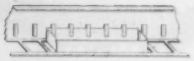


Series 77

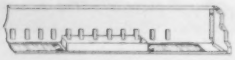
NEW RETURN AIR GRILLE with maximum free area, for matching beauty and performance.

FASTER INSTALLATIONS

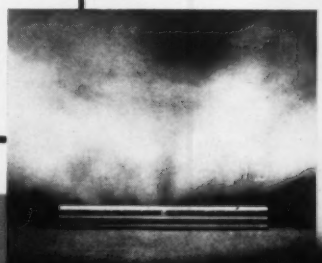
IN NEW AND OLD HOUSES



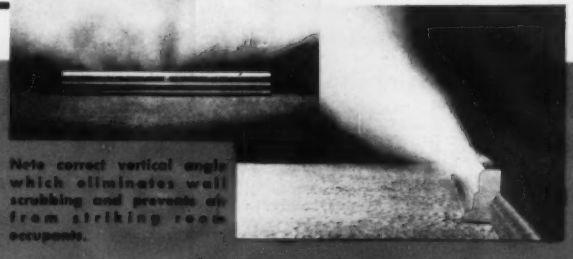
Boot can be quickly located any place along bottom of diffuser or grille without expensive cutting. Base has pre-cut boot openings separated by easily removable 3/8" mullions and boot fastening clips stamped in back section to hold boot in place.



Steel strip furnished with diffuser unit to seal openings not used. The entire operation is done in a jiffy.



Smoke test photos show full fan-shaped blanket of air spread over wide area. Air pattern holds constant even at low cfm delivery, and velocity remains uniform without whistling.

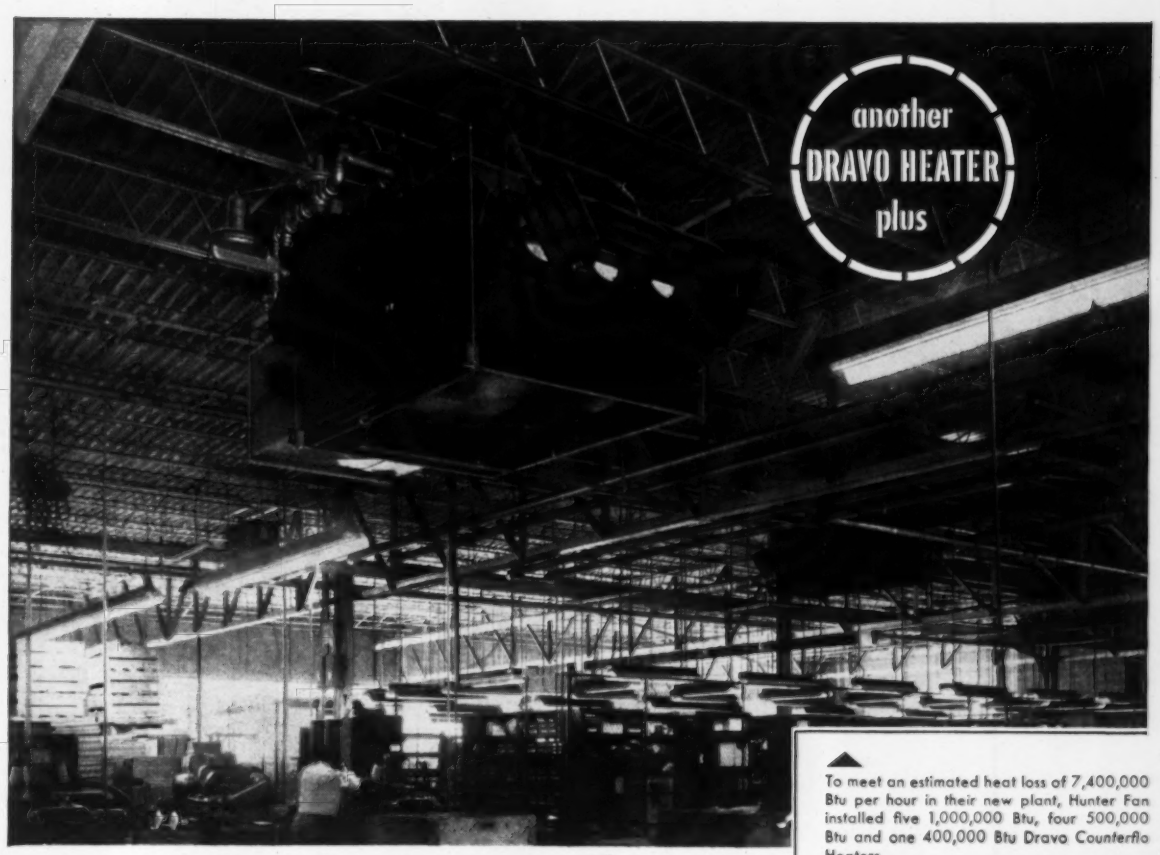


Note correct vertical angle which eliminates wall scrubbing and prevents air from striking room occupants.

Lima REGISTER CO.
LIMA, OHIO

INDOOR COMFORT

Lima Quality Diffusers, Registers and Grilles Are Sold Exclusively Through Heating Wholesalers and Manufacturers.



To meet an estimated heat loss of 7,400,000 Btu per hour in their new plant, Hunter Fan installed five 1,000,000 Btu, four 500,000 Btu and one 400,000 Btu Dravo Counterflo Heaters.

The new L-shaped factory building, 350 by 420 feet, supplies 108,000 square feet of manufacturing and storage space. Dravo Heaters meet varying heat requirements easily despite the fact that one-sixth of plant's total wall space is window area.

Southern factory finds economical answer to plant heating problem

Much of the South's rapid industrial expansion can be credited to its year-around sunny, mild climate. But this same climate has presented some unique heating problems to manufacturing firms like Hunter Fan and Ventilating Company of Memphis, Tennessee. Their particular problem was to provide an efficient yet economical heating system for their new factory building.

In addition to the normal heating requirements, experience indicated that "chill" conditions prevailed during many winter and early spring days, particularly in the morning hours. This "part time" heat requirement indicated the need for a conventional system that could not only handle their normal needs but also have sufficient flexibility to meet these varying demands. Specifically what they needed, Hunter plant engineers decided, was a system that instantaneously handled a wide variation of heat requirements and yet was low in initial cost, maintenance, and compact enough to fit limited space in modern, low factory structure.

As cooling and ventilating specialists, they examined and evaluated all types of heaters and heating systems. Ten Dravo *Counterflo* heaters were found to be the ideal answer to their plant heating requirements.

Regardless of your plant location—East, West, North or South—you'll be dollars ahead by carefully investigating Dravo's quality heaters to see how their many features work for over-all heating efficiency and economy every day of operation. The coupon below will bring you all of the details—mail it today!

Dravo Corporation, Department A-1409
Fifth & Liberty Avenues
Pittsburgh 22, Pa.

I am interested in Dravo Heaters for _____

☐ Please send literature
☐ Please have a representative call

Name _____

Company _____

Address _____

City _____ Zone _____ State _____

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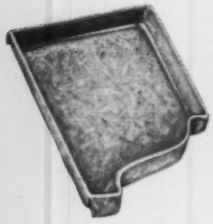
CORPORATION
Pittsburgh 22, Pennsylvania
Representatives in principal cities



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THE STRONGEST MADE BY ANY GALVANIZED SHEET:

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If you've been having difficulty fabricating galvanized sheets, try Wheeling SOFTITE Galvanized Sheets.

Here are sheets you can work to the limits of the base metal . . . so ductile, so tight-coated, you can use them for anything you make of steel sheets.

Bead it, draw it, seam it . . . you name the operation . . . Wheeling SOFTITE will take it and come back for more . . . with never a trace of chipping or flaking of coating. And for good reason – SOFTITE *has the tightest zinc coating yet produced.*

Put SOFTITE to the test. See for yourself why the demand for SOFTITE has forced Wheeling to triple its production facilities in 1955.

Galvanized steel does it better . . . SOFTITE *does it best!*

Send for full information today. Call or write the Wheeling sales office nearest you.

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BELOW: *Among the many features of the lobby are the clerestory illumination, the unobtrusive air diffusers, and the bas relief mural carved in wood by Buck Winn, Jr.*

Architects: Prinz and Brooks
General Contractor: Burgher Construction Co.

The New Look In

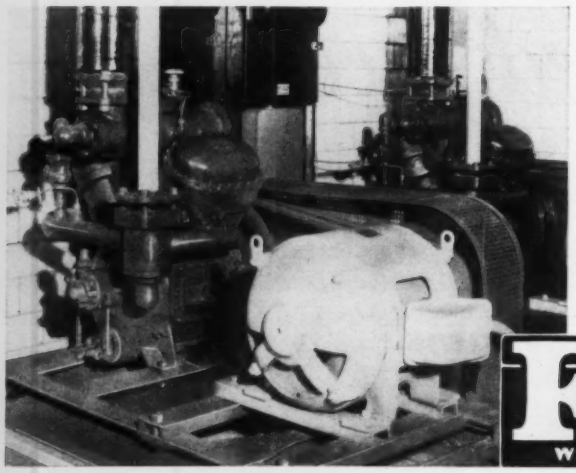
• Architecture
• Air Conditioning

The Oak Cliff Savings and Loan Association started eight years ago with $35,000—now has resources of $30,000,000. Its new building at Bishop and Center Streets is one of the finest in Dallas, and was awarded first honors for non-residential construction in 1954 by the Texas Society of Architects.

The entire structure, including the lobby, conference and accounting areas, community room and lounge, is air conditioned with two Frick "ECLIPSE" compressors. Each refrigerating machine is driven by a motor of 40 horsepower.

When you want the ultimate in quality and dependability . . . whether for air conditioning, refrigeration, ice making or quick freezing . . . specify FRICK.

Get quotations now on the equipment you need: Branch Offices and Distributors in principal cities, the world over.

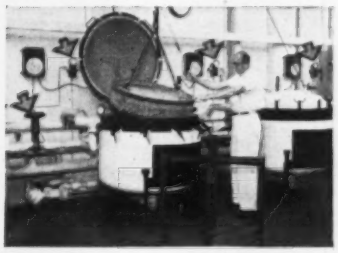


DEPENDABLE REFRIGERATION SINCE 1882

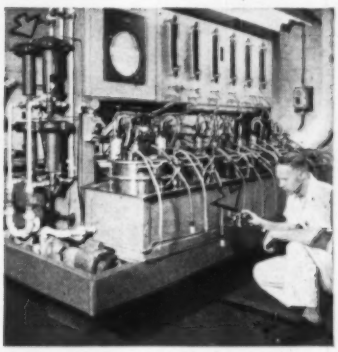
FRICK CO.

WAYNESBORO, PENNA. U.S.A.

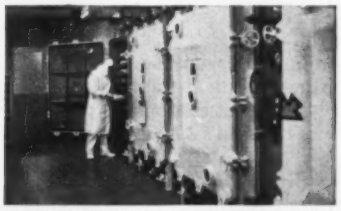
Shaker room and incubator in Fermentation Department. Powers Temperature Recording Controllers are used here.



Ampoule Sterilizers regulated by Powers No. 252 Pressure Regulators and Valves.



Fermentation process in research pilot plant controlled by Powers ACCRITEM Regulators and FLOWRITE Valves.



A few of the many vacuum dryers equipped with Powers Temperature Controllers.

Below: Air Conditioned Room for Board of Directors and executive conferences.

POWERS

AUTOMATIC temperature, humidity and pressure control

.... helps Abbott Laboratories bring better health to millions

Heating and Air Conditioning in many of the above buildings are automatically regulated by Powers Temperature and Humidity Control Systems.

Research at Abbott's has paid off in an unbroken dividend record, numerous stock dividends and splits. Many of their famous products such as Nembutal, Pentothal, Erythrocin, Iberol, Vi-Daylin, Selsun and Sucaryl have been developed in laboratories equipped with Powers control.

Versatility of Powers control used at Abbott's is indicated by some of the applications shown here and in the following installations: Air conditioning control systems for auditorium with 900 seating capacity, executive offices and dining room, cafeteria and animal rooms; also controls for tablet machines, demineralized water heaters, autoclaves and many other applications.

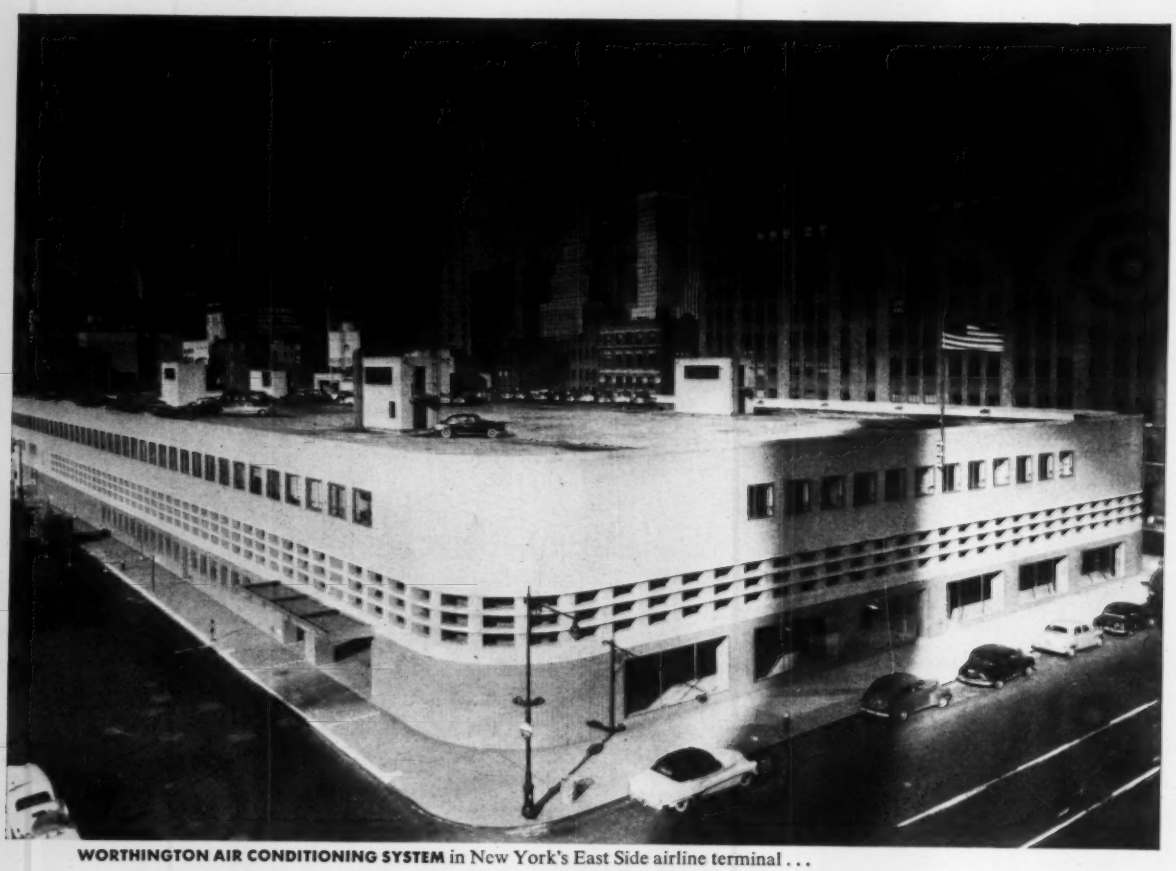
When you need automatic control for temperature, humidity or pressure, call your nearest Powers office or write us direct. An experienced Powers engineer will gladly help you select the right type of control for your requirements.

(c42a)

THE POWERS REGULATOR COMPANY

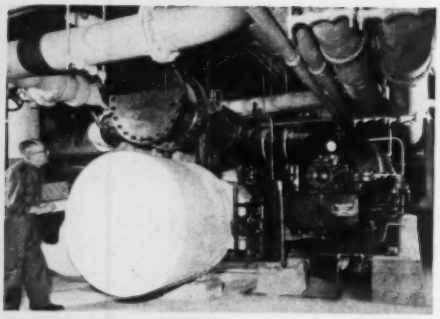
SKOKIE, ILLINOIS | *Offices in chief cities in U.S.A., Canada and Mexico*

Over 60 years of Automatic Temperature and Humidity Control



WORTHINGTON AIR CONDITIONING SYSTEM in New York's East Side airline terminal . . .

. . . cools 12,000 airline passengers a day



CHILLED WATER to air condition new airline terminal is supplied by this efficient Worthington centrifugal refrigeration unit.

Passengers stay cool and comfortable in New York City's new East Side Airline Terminal while waiting for their trip to the airports.

A joint enterprise serving 21 U. S. and foreign flag airlines, the new terminal accommodates over 12,000 people a day.

And for this modern building, nothing less than a truly modern air conditioning system would do. That's where Worthington came in. A Worthington-engineered, Worthington-built 315-ton centrifugal refrigeration system, along with Worthington air handling equipment and pumps, carries the entire cooling load for the terminal's 3,300,000 cubic feet of space.

Worthington air conditioning equipment has been the choice of leaders in business and industry for over 50 years. For the reasons why, write Worthington Corporation, Air Conditioning and Refrigeration Division, Section A.5.36.HP, Harrison, New Jersey. A.5.36

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CLIMATE ENGINEERS TO INDUSTRY, BUSINESS AND THE HOME

Special Facilities for Unusual Service!

THE COMPLETE LINE OF AIR DIFFUSION EQUIPMENT

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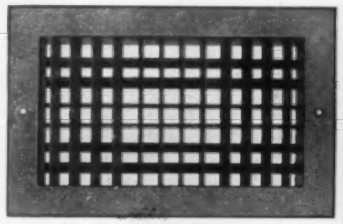
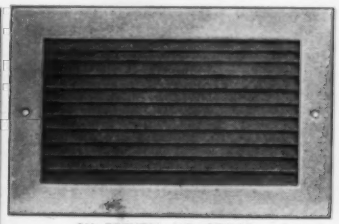
Since 1902

Our Production is Geared for the Exacting Requirements of the Commercial Field.

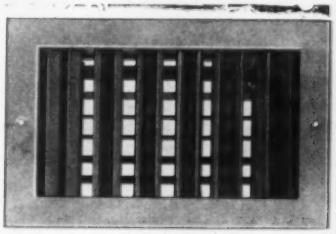
When you need emergency delivery, we can expedite your order without interrupting a diversified production schedule that is providing the *fastest regular* SERVICE in the industry. Join with the many leading architects, engineers and contractors who specify WATERLOO for the finest schools, churches, hospitals, industrial, government and office buildings, and other commercial structures.



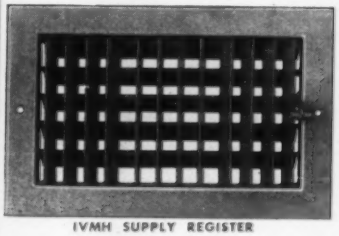
2V SUPPLY GRILLE



3H RETURN AIR GRILLE



2VO SUPPLY REGISTER



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DUCTROL Air Volume Extractor

EXCLUSIVE!

Silent Flow TEAR DROP Louvre Design

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Style is all-important when selling women's garments. And style is also a vital consideration in building quiet, efficient air conditioners. The UNARCO *ROYAL-AIRE*® is a smooth-operating conditioner, that is functionally styled to provide *balanced* air intake, assuring quiet performance.

Wherever people gather the UNARCO *ROYAL-AIRE* supplies comfort cooling, adding distinction and profit. Salesmen and customers alike are more relaxed, *more receptive* when comfortably cooled.

Plus features of the *ROYAL-AIRE* include an accessible hermetic compressor that minimizes maintenance, an oversize variflow blower and vertical cooling coil to provide maximum output, and the exclusive UNARCO pump-down control system which guarantees instant response.

For clothing store or drug store, restaurant or office, the *ROYAL-AIRE* is your *economical* buy! We invite inquiries and shall be happy to send you descriptive literature. Write HEATING & COOLING DIV.

UNION ASBESTOS & RUBBER COMPANY
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UNARCO ROYAL-AIRE *a distinctive* **AIR CONDITIONER**

Wagner®
ELECTRIC MOTORS
...the choice of leaders in industry

NEW!
Wagner Type DP* Motors
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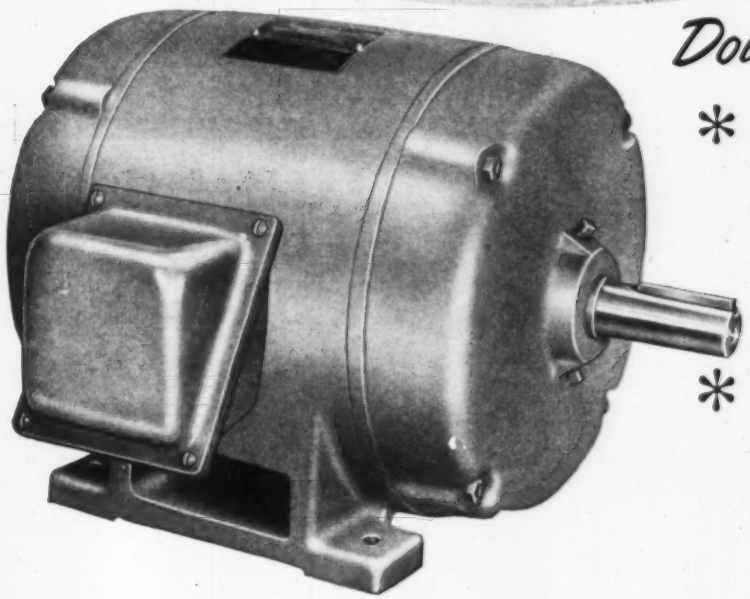


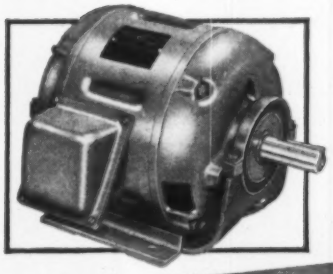
* Wagner Type DP Motors are protected by rugged, corrosion-resistant cast iron frames, smoothly rounded so that no moisture can collect on them. Motor feet are cast as an integral part of the frame for maximum strength and rigidity.

* Enclosures are drip-proof plus! Air intakes are located at the bottom of the endplates — air outlets are located at the base of the frame, one on each side. Specially designed baffles provide protection for the stator windings.

The Wagner line of polyphase, drip-proof general purpose motors—rerated to the new NEMA Standards—pack more power into smaller frames, but give you the same high Wagner Quality and long life performance that have made Wagner Motors "the choice of leaders in industry" for many, many years. These new Wagner Motors are fully protected in the ball bearing models. Their construction makes them completely drip-proof — and virtually splash-proof. The extra large, diagonally split conduit box makes wiring easy. Smaller size and lighter weight means more economical handling and installation.

These new rerated Wagner Motors retain the features desired by plant engineers and maintenance men. They will operate for years without regreasing. But . . . when lubrication *is* necessary or desirable, you *can* lubricate these motors because they are provided with two lubrication openings.

Bulletin MU-202 gives full information—write for your copy today.



AVAILABLE WITH RESILIENT MOUNTING —SLEEVE BEARINGS UP THROUGH 5 HP.

These Wagner standard motors, in ratings up through 5 horsepower, can be used for specialized applications because they are available in sleeve bearing models with endplates that will take resilient mounts.

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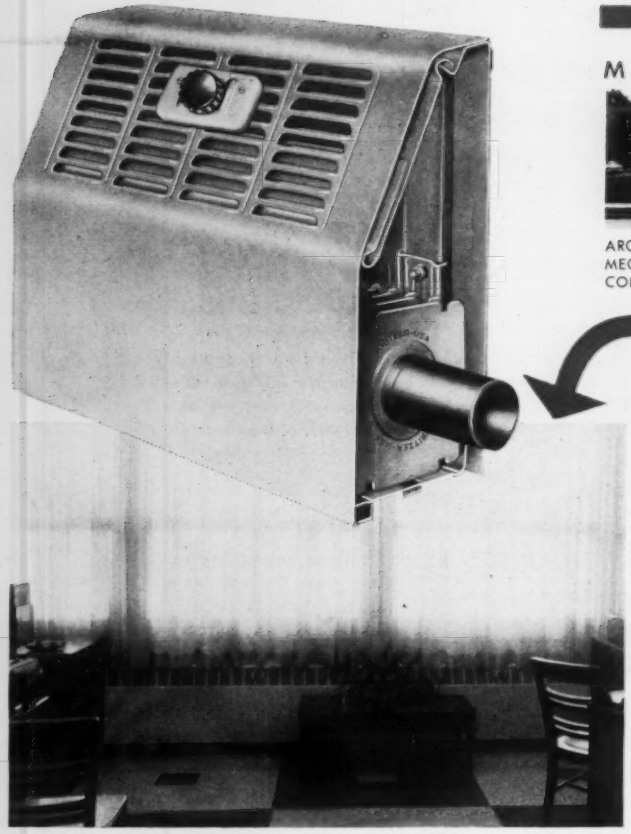

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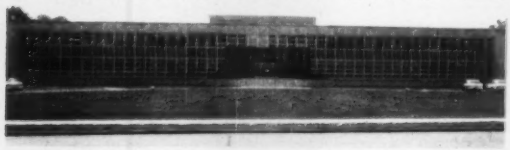

ARCHITECTS: *Neville, Sharp & Simon*
MECHANICAL ENGINEERS: *Howarth, Scott & Kinney*
CONTRACTOR: *A. D. Jacobson Plumbing & Heating Co., Inc.*

EFFICIENT

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Radiant Baseboard

enhances the interior of the Midwest Research Institute in Kansas City, Missouri, with beauty and quiet warmth.

KRITZER'S Slope Top Baseboard is constructed for a lifetime of heating service. It is made of heavy gauge steel and die formed to withstand the knocks and bumps of everyday usage. Because of this functional design, its simple, attractive appearance is at home in any interior.

KRITZER Slope Top is recommended for commercial, institutional, or industrial applications because of its higher capacity and wide range of sizes. This baseboard has been laboratory tested and ratings are Certified so that estimating and performance is assured. All KRITZER products are guaranteed for materials and workmanship.

KRITZER engineers would be pleased to give you more detailed information. See your jobber or write to Kritzer Radiant Coils, Inc., 2901 Lawrence Avenue, Chicago 25, Illinois.

Exclusive KRITZER Features

PATENTED DAMPER AND CONTROL can be placed at any point along the baseboard. No hinges to bind; no chains to break; no springs to wear out; no holes to drill.

ADJUSTABLE COIL SUPPORT BRACKET AND SLIDE CRADLE carries the coil which rides on the self-aligning Slide Cradle. Quiet operation is assured during contraction and expansion of the coil. These advantages, at no extra cost, build customer satisfaction and future sales.

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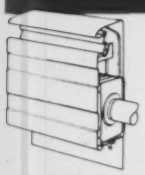
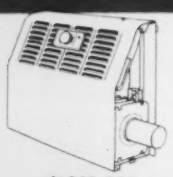
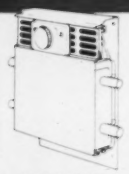


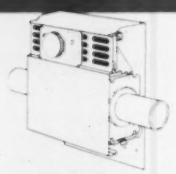
"K" LINE BASEBOARD



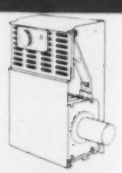
SLOPE TOP BASEBOARD



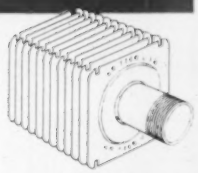
STANDARD BASEBOARD



UNIVERSAL BASEBOARD



CONVECTOR, SLOTTED FRONT



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Here's New Sales Help for

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Get more business

NOW!

The Thermostat with the DIAL you can READ!

NEW—HANDSOME—EFFICIENT

THE *Classic* is STYLED to SELL with—

EYE APPEAL You sense it at a glance! The CLASSIC blends gracefully with either period or modern decorating to accent the beauty of any room. CLASSIC is a masterpiece of crisp, balanced symmetry. The easy to read satin-black face is protected by a crystal-clear unbreakable lens. The gold-finished case completes its fine appearance.

FUNCTIONAL DESIGN One large numbered dial shows *both* temperature and setting. Horizontal dial is far easier to read and eliminates inaccurate reading due to angular vision. Convenient temperature adjustment is immediately beneath the indicator.

TIMED CYCLING Featuring the *new* two wire *adjustable* heater, Detroit's Timed Cycling CLASSIC eliminates overheating and underheating. It controls room temperatures within a fraction of a degree, provides the ultimate in comfort and economy.

SELL the Thermostyled *CLASSIC* for CUSTOMER SATISFACTION!

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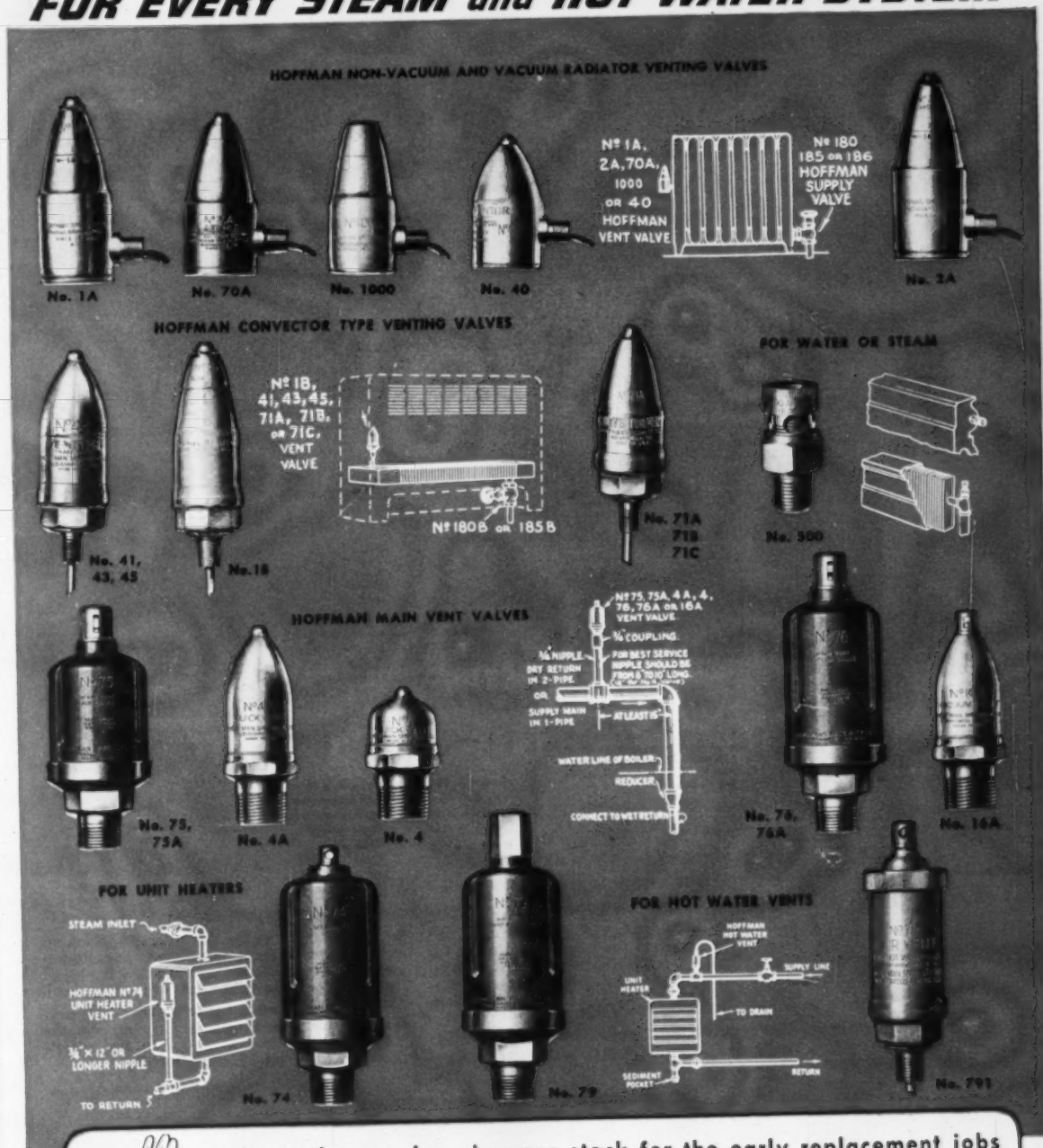
FOR EVERY STEAM and HOT WATER SYSTEM



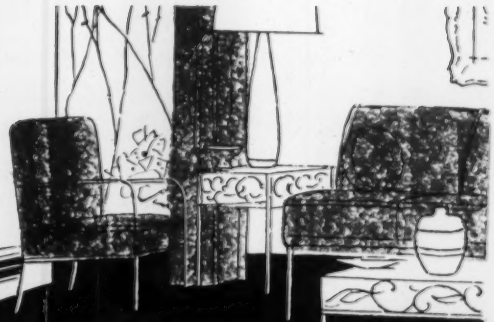
Have these valves in your stock for the early replacement jobs

For either one-pipe or two-pipe steam, hot water, residential or industrial heating—Hoffman assures you the correct Vent Valve for each specific requirement. Radiator Valves all feature the hinged drainage tongue. For the hard-to-balance radiators, the Hoffman line includes adjustable-port valves, available for vacuum and non-vacuum systems. It is not too early to order adequate stocks of main and radiator vent valves for modernizing jobs. Call your wholesaler.

HOFFMAN SPECIALTY MFG. CORP. • 1700 West 10th Street, Indianapolis 7, Indiana

Makers of Valves, Traps, Hot Water Heating Systems, Vacuum and Condensation Pumps . . . Sold by Leading Wholesalers of Heating and Plumbing Equipment

"Perimaheat"



Baseboard Convectors by YOUNG

easy to stock . . . easy to install —

Just 2 Convenient Sizes To Stock —

Six and eight foot sections. *Perimaheat* packages are clearly labeled on the ends for easy identification, and require a minimum of stacking space.

Flat lightweight packages. Wood blocks with round cutouts retain tube at ends of packages, and hold element and cabinet in positive position during all stages of handling.

Sturdy, lightweight packages are easy to inventory.

One-piece back and top make for easy installation . . . eliminate air leakage and streaking. Simply pierce back at stud locations and nail.

Place back to wall and nail to studs.

Install hanger wires and slip in heating element. Make pipe connection, snap-on front cover, joint covers, end caps. Damper or splitter (optional) snap-in place at any time.

Snap-on front cover, joint covers, corners and end caps.

Jobbers find compact *PERIMAHEAT* Baseboard packages easy to handle, easy to stock. Heating contractors prefer the simplified installation created by perfectly fitting parts and *PERIMAHEAT* snap-on features.

PERIMAHEAT is manufactured by Young Radiator Company, specialists in heat transfer for over 28 years. This combination of compact packaging, simplified installation and the manufacturer's reputation for quality heating products creates product demand.

Mail coupon today for complete *PERIMAHEAT* Baseboard details . . . or see the Young Representative listed in the yellow pages of your telephone directory.

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Fire Tube types to 600 b.h.p. (Write for Catalog 704 F).
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Man will reach the moon . . . tomorrow perhaps . . . but more than likely "tomorrow" in the dictionary of scientists means 20 years . . . and that's a long time to pay the penalty of high steam costs. A boiler is a long term investment; and the equipment you buy today determines your steam costs for years to come.

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STEAM GENERATORS

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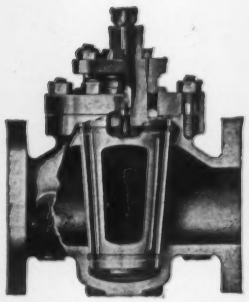
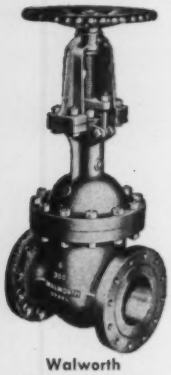
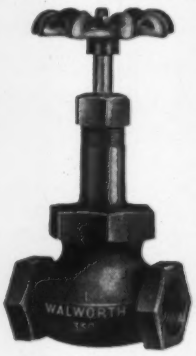


Walworth
Lubricated Plug Valve



Walworth
Steel Gate Valve

Walworth
Iron Body Gate Valve



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Walworth manufactures a *complete line* of valves and pipe fittings: all made to the highest standards of quality, both as to dimensional accuracy and metallurgical properties. In design, construction, and performance, Walworth products reflect more than a century of experience in the manufacture of quality valves and fittings.

Your Walworth distributor will give you full information on the *complete line* of Walworth steel, iron, and bronze, and special alloy valves and pipe fittings; also Walworth Lubricated Plug Valves, and Walseal* valves, fittings and flanges. Ask for this information today.

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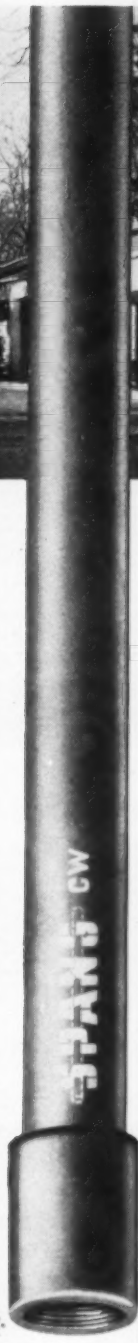


SPANG® CW STEEL PIPE GIVES
TOP-QUALITY SERVICE AT MERRY ACRES MOTEL

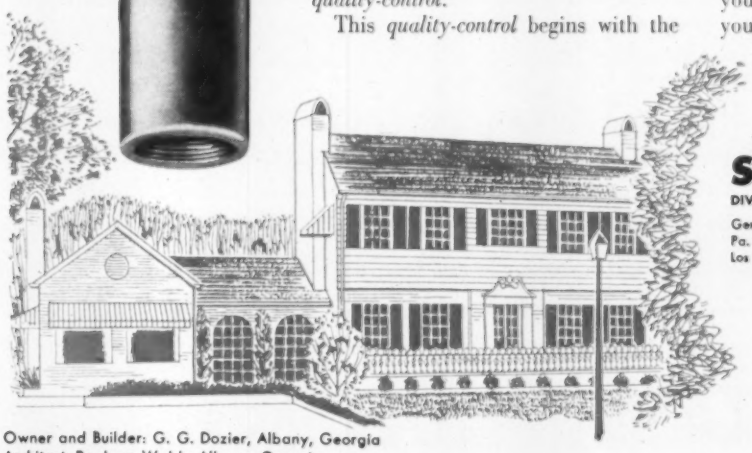
Merry Acres Motel, situated on ten acres of beautiful ground in a quiet suburban section of Albany, Georgia, is typical of the many new motels that line our highways, offering *top-quality* service to motorists. Each of the 33 rooms at Merry Acres was planned to give overnight guests maximum comfort and convenience.

To assure a *top-quality* plumbing installation in each room, 2,165 feet of SPANG CW Steel Pipe were installed. The specs called for SPANG CW, not only because it is easy to work with, but also because it has a *top-quality* reputation for giving years of dependable service. These two important factors are the result of SPANG'S careful *quality-control.*

This *quality-control* begins with the selection of *top-grade* skelp, continues through the close control of the manufacturing process, and includes the final inspection and testing of the finished pipe.

Quality-controlled SPANG CW is easy to bend, cut, thread and weld. It has strong, uniform welds; smooth, clean inside finish; uniform diameter . . . all important features in lowering installation time and costs.

Why don't you take advantage of SPANG'S *quality-control?* Whatever your piping needs may be—radiant heating, snow-melting, plumbing, air conditioning or water lines—SPANG CW Steel Pipe will give you *top-quality* service. See your local SPANG Distributor, for your next order of pipe. He will give you *top-quality* service, too.



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Why you're ahead 3 ways with Modine UNIT HEATERS

Horizontal Unit Heaters are built in 21 standard and low-outlet-temperature steam models, 5 hot water models. Verticals are available in 26 models, 13 sizes for steam and hot water. And there are 10 Power Throw standard and low-outlet-temperature models.

Special HCR Models for use where corrosion is a problem

To reduce maintenance and replacement costs in systems where corrosion is inherent, Modine offers a specially built line of premium units. These HCR models retain the light weight and excellent performance of standard Modines — ALSO PROVIDE EXCEPTIONAL RESISTANCE TO INTERNAL CORROSION.

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Superior design and engineering of Modine steam and hot water unit heaters provides stepped-up performance and greatly reduced weight and bulk. Largest model . . . 2540 Edr. . . . weighs only 248 lbs. Light weight and compactness make Modines easier to handle and install. You save money right from the start.

2 Extra operating economy

All models feature discharge air temperatures in the 110° to 120° range. Exact temperatures are correctly related to discharge velocity to insure desired heat throw and perfect comfort . . . optimum fuel economy. Horizontal models feature built-in velocity generators which step up heat throw for greater penetration of cold air strata near floor.

Modine
UNIT HEATERS

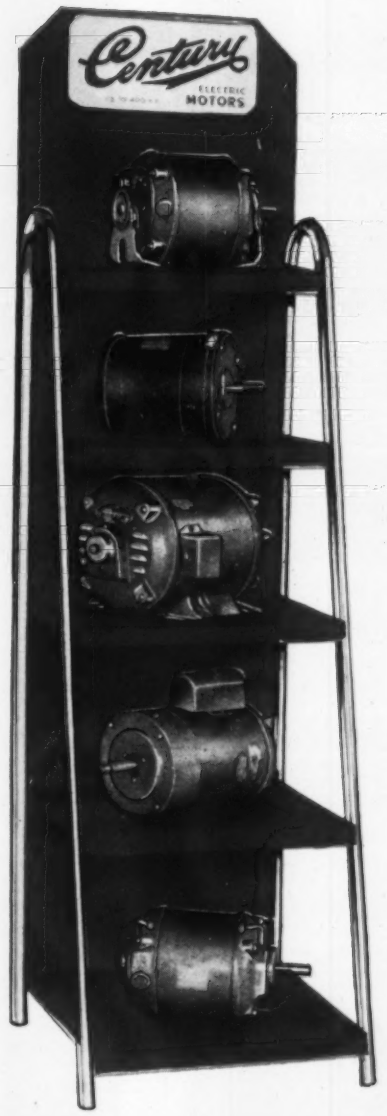
3 Long life, low maintenance

Design which utilizes latest advances in metallurgy and quality construction in modern manufacturing facilities results in unit heaters that stand up for years at minimum cost for maintenance and service. Report after report confirms the fact that Modine buyers become solid Modine boosters.

Bank on Modine experience to help you plan more efficient heating systems

For more than 25 years, Modine has been a leader in the development and application of steam and hot water unit heaters. A conference with your Modine representative will help you simplify the problem of meeting specific temperature, air delivery and location requirements.

Ask him for free booklet No. 155 or write direct — Modine Mfg. Co., 1509 DeKoven Avenue, Racine, Wisconsin. SU-1268



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Incorporating the Level Master Element on standard Sporlan thermostatic expansion valves.

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Made for Valve Types P-H-M-V-W-D-A

A Positive Liquid Level Control for Ammonia, Freon-12, and Freon-22 with all these features!

1. **Modulated Flow.** The Level-Master Control provides a modulated flow and maintains practically a static liquid level in the low side.
2. **No Moving Parts.** The insert bulb controlling the liquid level has no moving parts. Control does not operate through use of a mechanical float device of any kind.
3. **Simplified and Economical Installation.** The insert bulb can be placed directly in the shell, accumulator or liquid leg for direct contact with refrigerant. Existing float control systems can be easily and economically converted.
4. **Not Affected by Turbulence.** Regardless of any agitation which might occur in the low side, the effect on the Level-Master is merely that of striking a mean level and holding that level constant.
5. **Tight Closing.** Tight closing is assured by the spring action in the thermostatic expansion valve during shut down periods when the heater element is off and liquid refrigerant is in contact with the bulb.
6. **Proven Thermostatic Expansion Valve Performance.** On Ammonia, use of discharge tube on smaller capacities minimizes danger of seat errosion.

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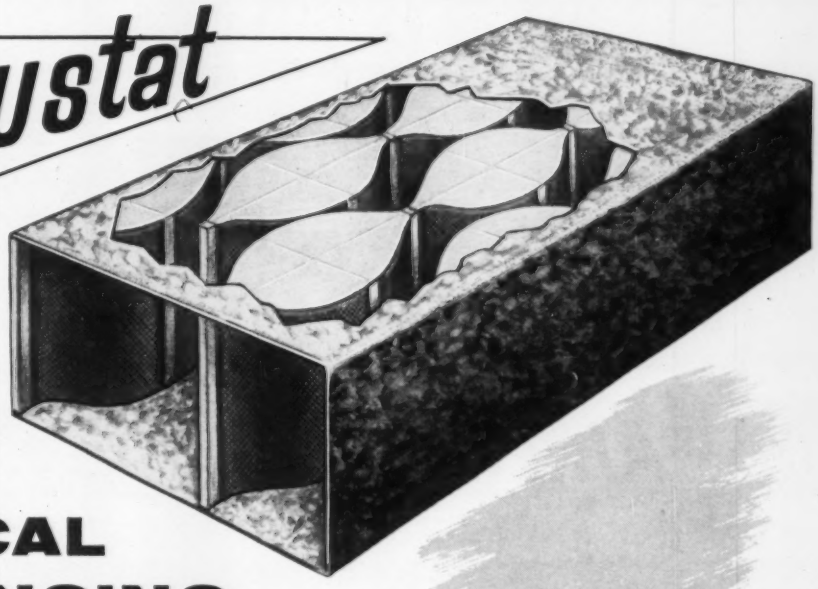
Aircoustat



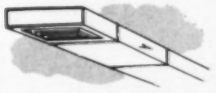
PRACTICAL SILENCING

for AIR CONDITIONING SYSTEMS

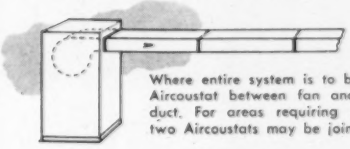
Aircoustat is a compact, *completely packaged* unit for silencing fan and air noise in air conditioning systems. Easily installed directly into the duct work, Aircoustat eliminates the need for costly, extensive duct lining. And results are astonishing: one *7 foot* unit reduces noise level below what *100 feet* of commercial duct lining could accomplish.

Engineered to provide broad band attenuation with low pressure drop, Aircoustat is available in 14 standard sizes for use with all styles and sizes of duct, and 8 types to meet any desired conditions. Selection is no problem: ***if it fits geometrically, it fits acoustically.***

Where to install Aircoustat



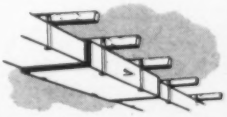
Aircoustats are incorporated as part of the duct work. If only selected areas require quiet, install above individual diffusers.



Where entire system is to be silenced, insert Aircoustat between fan and first length of duct. For areas requiring special silencing, two Aircoustats may be joined in series.

How to install Aircoustat

Aircoustat requires no special tools for installing. It is constructed to be joined to ductwork with a lock seam.



If ductwork and Aircoustat differ in size, a canvas or asbestos coupling may be used. If ductwork is hung, support Aircoustat similarly.

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SILENCE SERVICE

Industrial Sound Control Inc.
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INDUSTRIAL SOUND CONTROL, INC.
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Please send me more information on AIRCOUSTAT.

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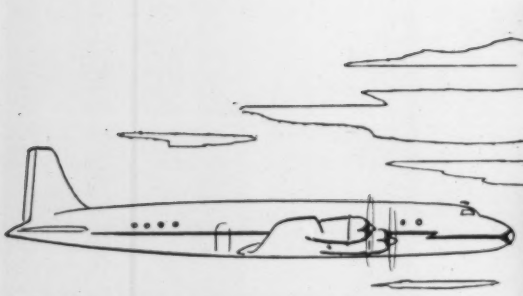

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ventilating problem

solved with

JOY AXIVANE FANS

The Tulsa Overhaul and Supply Depot is a nerve center for refurbishing the American Airline Flagship Fleet. Here, hot climate and concentration of technicians working inside the airplanes necessitate serious attention to good ventilation.

Anxious to provide maximum comfort and safety and to conserve floor and storage space, American revised their system. Investigation led to the selection of a Joy AXIVANE fan, equipped with an explosion-proof motor.

The compact vaneaxial design of the AXIVANE fan permitted a permanent, "out-of-the-way" installation in the hangar ceiling trusses. The fan exhausts through 27 feet of 'Spiratube' attachable to an airplane emergency exit. In addition to pulling stale air, fumes, and dust out of the cabin, the fan circulates fresh air through the hangar.

American has added six more AXIVANE fans and has equipped both the Convair and DC-7 hangars with this Joy cabin-ventilator system to replace larger, troublesome, less efficient portable blowers.

There is a Joy AXIVANE fan for any aviation, electronic or industrial application. For details, write for Bulletin J-611, TODAY, to ***Joy Manufacturing Company, Oliver Building, Pittsburgh 22, Pa.*** In Canada: *Joy Manufacturing Company (Canada) Limited, Galt, Ontario.*

Consult a Joy Engineer

about **PORTABLE AND STATIONARY COMPRESSORS, FANS, and OXYGEN GENERATORS**

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SPECIALISTS IN THE COMPRESSION AND MOVEMENT OF AIR AND GASES SINCE 1885

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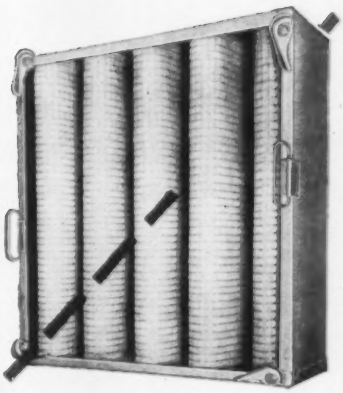
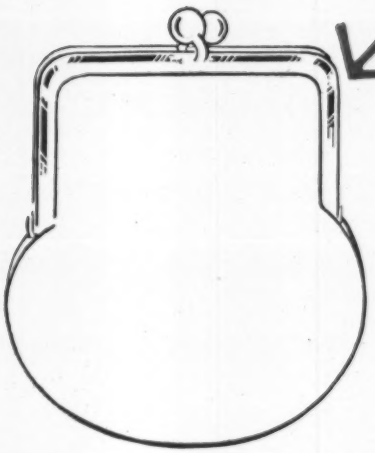


CA-24
24 x 24 x 8



HOW MUCH YOU'LL SAVE with CA-24 DYCON dry-type AIR FILTERS

Accurate comparative performance data on CA-24 filters and other leading filters will show you *why* you'll save. And the handy, comparative cost analysis sheet will help you compute *your actual savings* in a jiffy.

Your local Continental representative carries these important aids with him . . . in addition to a great deal of helpful information. Call him. He'll be glad to help . . . with no obligation.

Or, if you prefer, write direct for the comparative performance data and comparative cost analysis sheet . . . and convince yourself!

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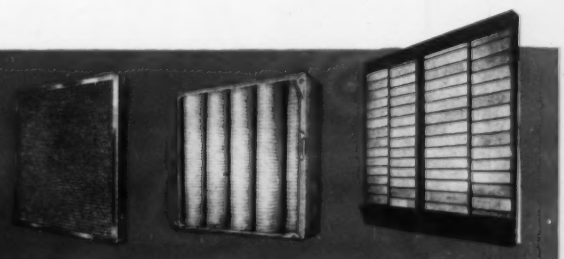
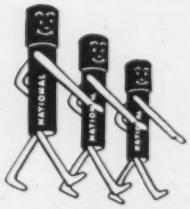
CONTINENTAL AIR FILTERS Inc.



In all types of building and industrial applications...

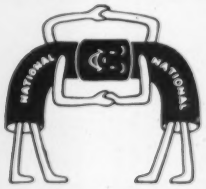
NATIONAL PIPE IS CHOSEN CONSISTENTLY *because*—



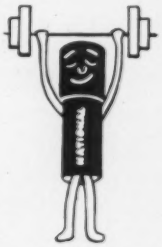
It's uniform throughout—National Pipe is uniform in metallic structure, ductility, strength, corrosion resistance, surface finish and diameter.

It threads and cuts easily—Absence of slag inclusions, laminations and blisters assures smooth, strong threads . . . clean cuts.

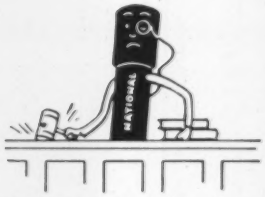
It coils and bends well—National Pipe has that extra strength and ductility so necessary to meet the demands for smooth, uniform coils and bends.



It makes sound joints—Uniformity and accuracy in manufacturing have made unequalled pipe jointing records for National Pipe . . . whether welded or threaded.



It's strong—Close metallurgical control of chemical and physical properties gives National Steel Pipe "built-in" strength.



It's rigidly controlled—From the raw material to the finished product, one organization has rigid control over the manufacturing steps that produce National Steel Pipe.

It's thoroughly tested—Each and every stage of production is carefully checked by the finest instruments . . . the most experienced men.

It's constantly improved—For over 60 years, National Steel Pipe has constantly been improved to meet the most difficult requirements.

It's gained nationwide acceptance—A cross section of industrial or building applications will show a predominant use of National Pipe . . . largest selling pipe in the world.

NATIONAL TUBE DIVISION, UNITED STATES STEEL CORPORATION, PITTSBURGH, PA.

COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS · UNITED STATES STEEL EXPORT COMPANY, NEW YORK

NATIONAL *Steel* PIPE

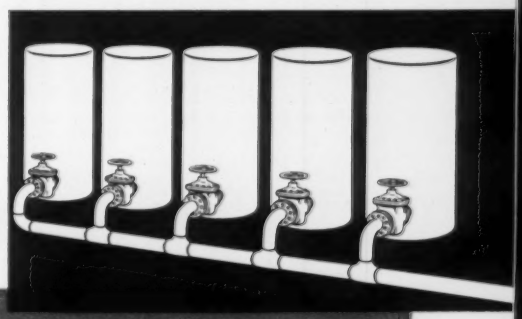
SEE THE UNITED STATES STEEL HOUR. It's a full-hour TV program presented every other week by United States Steel. Consult your local newspaper for time and station.

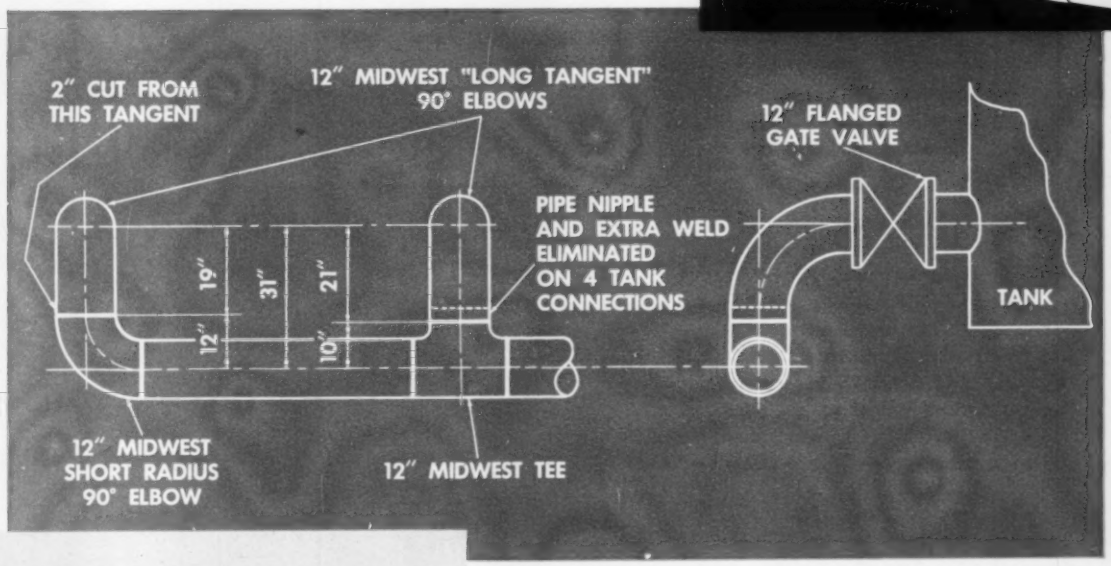
UNITED STATES STEEL

MIDWEST "LONG TANGENT" ELBOWS

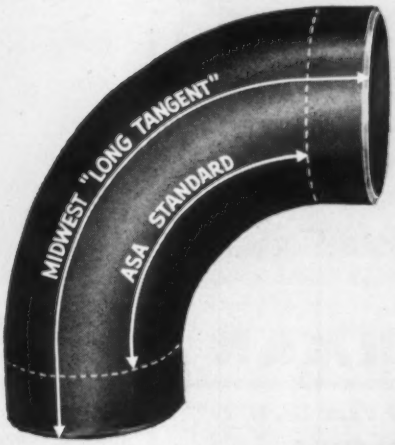
SAVED $156.20

On This Welding Piping





MIDWEST "LONG TANGENT" ELBOWS COST NO MORE THAN OTHER ELBOWS



The Problem:

To connect the five tanks shown in the sketch at top to a common 12" header.

The Difficulty:

The center-to-outlet dimension of the 4—12" tees is only 10", while the shortest elbow available measures 12" center-to-end. Thus, if standard long radius elbows are used next to the five tank valves, four short nipples and four extra 12" welds would be required.

The Solution:

By using Midwest "Long Tangent" elbows as shown in the blueprint, the expense of the four extra nipples and welds was eliminated at the cost of just one cut! The actual net savings made by "Long Tangent" elbows on this job was $156.20.

Remember—Midwest "Long Tangent" elbows cost no more than regular elbows! For further information, write for Catalog 54.

MIDWEST PIPING COMPANY, INC.

Main Office, 1450 South Second St., St. Louis 4, Missouri

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SIL-FOS brazed construction

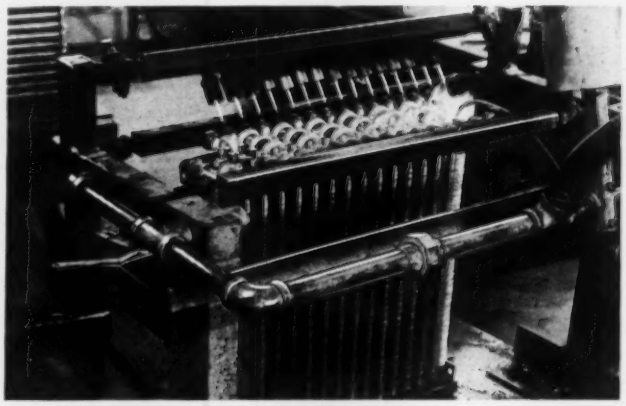
the EASY... FAST... LOW-COST WAY...

...TO DO JOBS LIKE THESE...

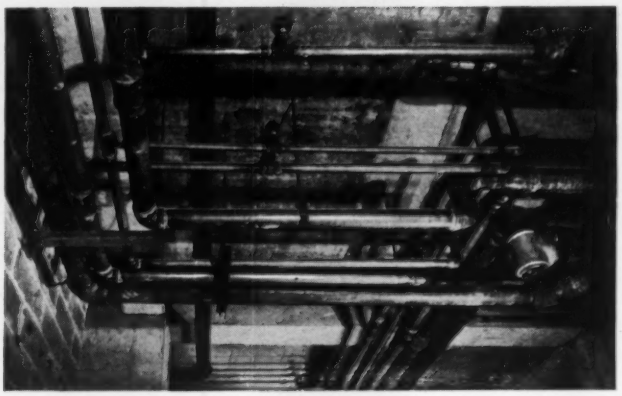
When it comes to joining non-ferrous pipe or tubing — either in the production of equipment or the installation of piping systems — SIL-FOS brazed construction is far and away the quickest and lowest in end cost.

Brazing with this low-temperature silver alloy is also the method that consistently produces the results esssential to such jobs — *permanently leak-tight joints that can't come loose and need no maintenance.*

For jobs involving both ferrous and non-ferrous pipe and tubing, brazed construction with the low-temperature silver alloy EASY-FLO, offers the same advantages and the same low end cost results.



SIL-FOS 5 wire rings by the thousands are used in assemblying the condensers and evaporators of the popular FEDDERS Room Air Conditioners. At right, return bends are being brazed to condenser tubes. Bends are assembled on tubes with rings of SIL-FOS 5 preplaced around tube ends, and brazed on the automatically-timed city gas-air burner setup shown. *Three rows (40 joints) are done in less than 1 minute.*



View of a small portion of the water lines in a 70-building, 4000-apartment, New York City housing project in which all hot and cold water lines were SIL-FOS brazed. Use of Type B copper tubing and elimination of threading, made possible by SIL-FOS brazed construction, saved tons of weight and metal and substantially cut installation time.

SEND FOR THESE 3 BULLETINS

BRAZING NEWS No. 61, BULLETIN 20 and BULLETIN 17 give you the facts about SIL-FOS and EASY-FLO brazing. Write for free copies.

HANDY & HARMAN
FOUNDED 1867
QUALITY · SERVICE
ORIGINATORS OF EASY-FLO & SIL-FOS

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General Offices: 82 Fulton St., New York 38, N. Y.

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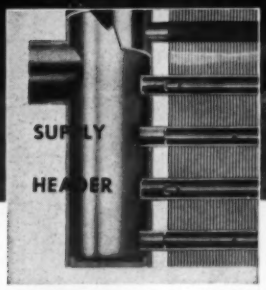
There's no ". . . or equal" for EASY-FLO and SIL-FOS

announcing...

Nesbitt series T surface with *Trombone* steam distributing tubes



Eliminates stratification on all surface lengths under reduced steam supply ...assures uniform temperature distribution...improves freeze-up protection

Trombone shaped tubes offer the most significant improvement in steam distribution since the advent of steam distributing tube surface pioneered and developed by Nesbitt.

With condensing tubes paired in serpentine fashion, the trombone distributing tube (discharging steam through orifices spaced along its entire length) serves two adjacent condensing tubes from a single supply header connection. Steam must traverse the full length of the trombone tube (thus the full length of the surface) before reversing direction, as the demand increases, to serve the second leg of the tube. Even the smallest amounts of steam—*entering only half the conventional number of tubes*—are made to travel *twice* as far across the coil length and to contact *twice* the surface area.

Nesbitt Series T Surface is unmatched for applications requiring uniform steam distribution under modulating valve control (heating and ventilating apparatus), and for those demanding freeze-up protection (preheating).

Available in two types (TS sections have steam and condensate connections at the same end, TO sections at opposite ends), one and two row depths, with aluminum or copper fins, in finned lengths from 12″ to 120″.

Send for details in Publication 305

Nesbitt
HEATING AND COOLING SURFACE
Made and Sold by John J. Nesbitt, Inc., Philadelphia 36, Pa.
Representatives in principal cities—see telephone directory

That's the long-life valve on sulphuric acid

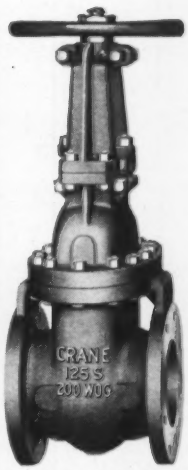
THE CASE HISTORY: At a large midwestern refinery there were recently two valves of different makes on a 90% sulphuric acid line. As seen in the photo above, these valves worked under identical conditions, almost side by side—each operated about three times daily.

Less than a year in the line, the valve at left started leaking, with the leak getting rapidly worse. In contrast, the Crane No. 475½ all-iron gate valve at right, with two years' continuous service to its credit, was still giving completely good performance.

That's Crane quality in valves—with a 100-year background in quality manufacturing. That's why Crane valves are the first choice of thrifty buyers in the petroleum industry as in all others. Crane Co., General Offices, Chicago 5, Ill. Branches and Wholesalers serving all industrial areas.

CRANE IRON BODY WEDGE GATE VALVES

Here are valves of unusual strength for their 200-pound W.O.G. rating. Body and bonnet are oval shaped, with extra metal where needed most. Their Crane-quality cast iron with highly engineered operating design makes these valves outstanding performers wherever they're used. A complete family to choose from. See your Crane Catalog or your Crane Representative.



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VALVES • FITTINGS • PIPE
KITCHENS • PLUMBING • HEATING

CRANE'S FIRST CENTURY...1855-1955

Double-Flow Aquatower

Packaged Double-Flow Aquatower

Marley Double-Flow* Aquatowers

DOUBLE-FLOW AQUATOWERS have a proud heritage: they are the only cooling towers in the intermediate capacity field backed by years of selective development. Behind them stand Marley engineering and design ability and the Marley Double-Flow patents, without which no cross-flow tower can deliver full performance from every cubic foot of structure.

These towers are thoroughbreds in every characteristic. Every element is designed, manufactured and guaranteed by Marley. Included are the sturdy structure, high-performance filling and drift eliminators, and all mechanical equipment—fans and drive units. All parts are service-proved in thousands of units now in completely satisfactory operation the country over.

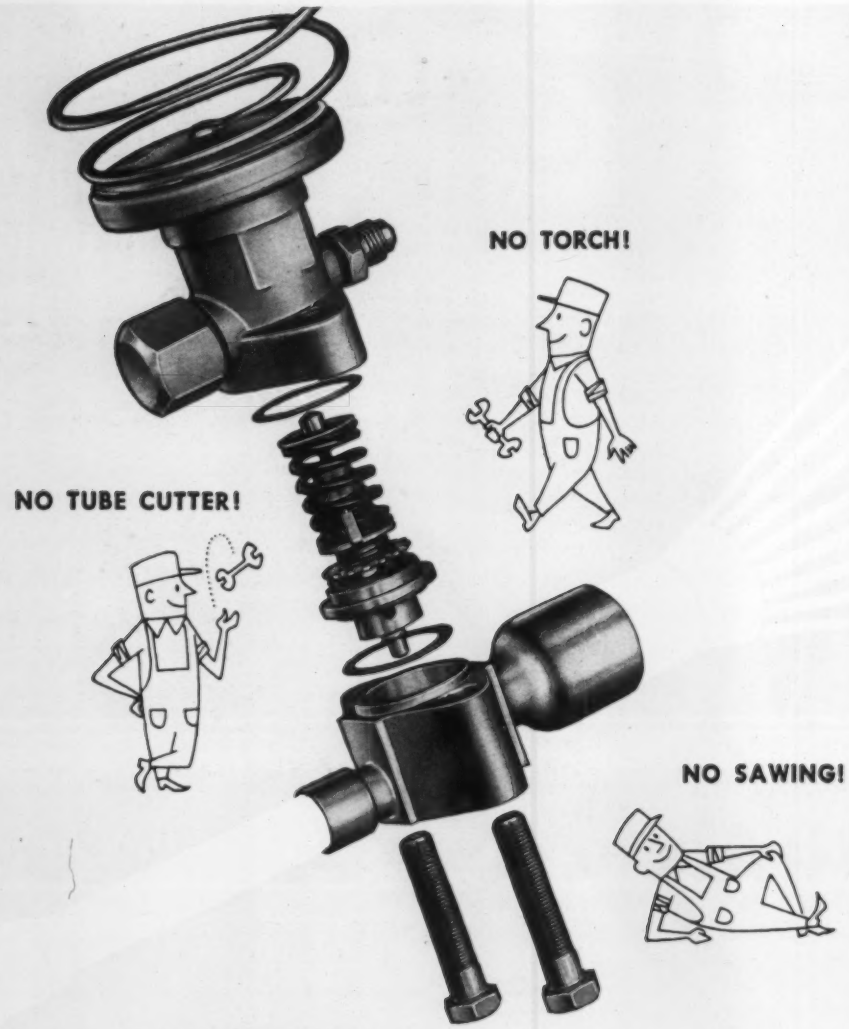
DOUBLE-FLOW AQUATOWERS are supplied with either asbestos cement board or steel casings for job erection. Steel cased PACKAGED DOUBLE-FLOW AQUATOWERS (60, 80 or 100 tons capacity) are shipped in three sub-assemblies that reduce construction time from days to hours.

*Trademark Reg.

MARLEY®

The Marley Company

Kansas City, Missouri



THE EASIEST JOB
ON ANY COOLING SYSTEM...
servicing ALCO "T" series thermo valves!

For cleaning, repair or capacity change: loosen two screws—raise the power element—lift out the cage. That's all! You never break the connections.

Designers and Manufacturers of Thermostatic Expansion Valves; Evaporator Pressure Regulators; Solenoid Valves; Float Valves; Float Switches.

see your ALCO wholesaler

ALCO VALVE CO.

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engineered for service for life

PRITCHARD LOLINE COOLING TOWER— SEVEN IMPORTANT WAYS BETTER!

1. The LOLINE has *galvanized* steel fan drive supports and basin accessories rather than cheaper, less durable painted steel.
2. The LOLINE brings grease fittings for the bearings on the V-belt drive to the outside of the tower for easier, safer maintenance.
3. The LOLINE features a *corrugated* asbestos cement board casing rather than flat asbestos cement board sheets—for greater strength and protection.
4. Lowest silhouette tower in the field, the LOLINE over-all height is just $7'\ 7\frac{11}{16}''$.
5. Asbestos cement board louvers are installed as standard, not special, equipment on all LOLINE towers, for better appearance.
6. The LOLINE offers you an internal pipe supply system which permits the architect or engineer to completely conceal the piping. This is optional equipment.
7. The V-belt drive on all LOLINE towers features a stainless steel fan shaft for longer tower life.

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COOLING TOWERS
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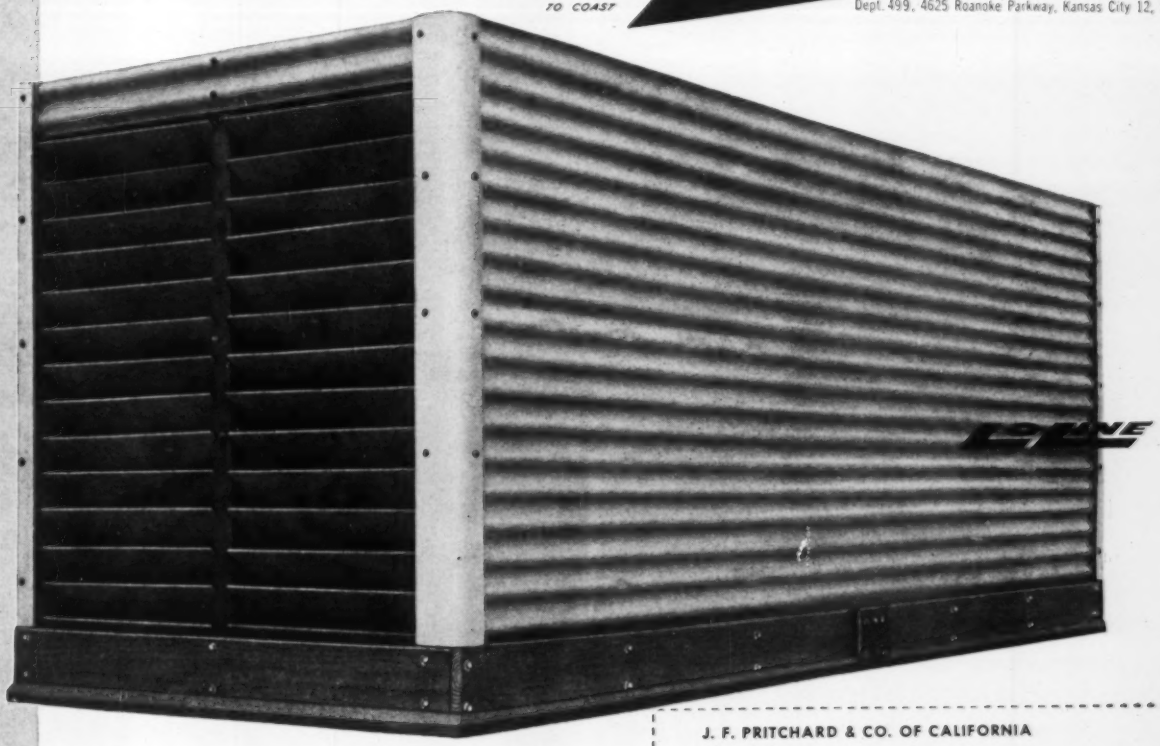

GET ALL THE FACTS!

NEW LOLINE BULLETIN is available to you absolutely free of cost or obligation. Tells you *all* the facts about the lowest silhouette tower of 75 tons capacity and up now available: Why the LOLINE was developed, illustrations and descriptions of framework and mechanical equipment, typical cross section, capacity table, optional equipment, name and address of Pritchard sales office nearest you. Send for your complimentary copy today.

J. F. PRITCHARD & CO. OF CALIFORNIA
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☐ Please send me the bulletin on LOLINE cooling towers.

☐ Please have your representative contact me.

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The 64 BOILER Question...

WITH NO QUESTION ABOUT PERFORMANCE

Q *"What is the most economical boiler we can install for efficient heating and adequate continuous hot water?"* was the question asked by the builders of 64-unit Hoskins Park at Quonset, Rhode Island.

A *"H. B. Smith 'Century' Gas Boilers"* were definitely the answer after a comprehensive study was made of all boiler types.

Here are the answers to why Smith "Century" Boilers were chosen over all others.

- The Smith "Century" is the only gas boiler available with an integral built-in tankless hot water feature of sufficient size to handle 4- and 5-apartment units. (Most heaters in this project are capable of supplying 8 gallons of water per minute). This domestic hot water feature meant considerable initial savings and subsequent maintenance costs which would have been necessary had separate hot water heaters been used.
- The Smith "Century" is the easiest boiler of its size to service. This is a most important factor since the project management naturally wishes to cut service to a minimum.
- The Smith "Century" is engineered from the ground up for long life and low maintenance. Every part from the stainless steel flue collector to the rugged cast iron burners with precision-drilled raised ports is designed with the utmost of operating efficiency and economy in mind. This is of prime importance in a project of this type.

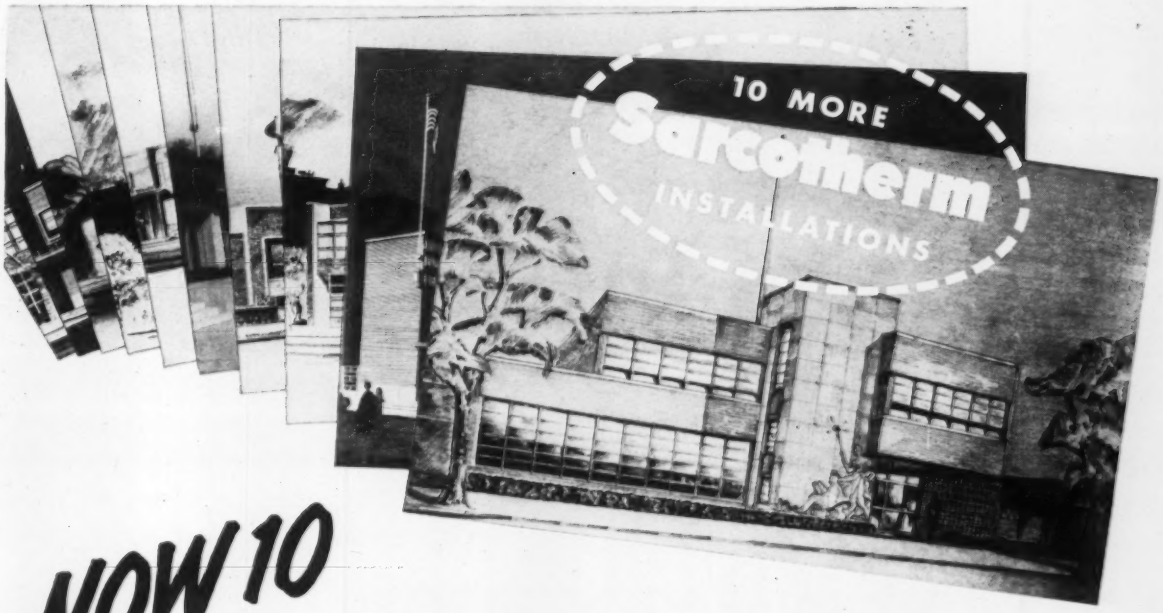
Now . . . the question answered and construction completed, 64 Smith "Century" Boilers of different sizes and capacity provide heat and hot water for 64 buildings. There is an administration building and 63 apartment buildings with a total of 350 four- and five-room apartments. The Providence Gas Company ran pipelines twelve miles to bring natural gas to this location.

AGA APPROVED
Input Ratings from 138,000 Btu to 745,500 Btu

Bulletin Free
Completely illustrates and describes the Smith "Century" Gas Boiler

H.B. Smith **CAST IRON BOILERS**

THE H. B. SMITH CO., INC., WESTFIELD, MASSACHUSETTS ***ESTABLISHED 1853***



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New York City Libraries Sarcotherm-equipped!

UNIFORM COMFORT under all weather conditions is of first importance to a library.

Sarcotherm heating controls, ventilating controls and specialties have been installed during the last two years in ten libraries, designed and constructed under supervision of the New York City Department of Public Works.

Sarcotherm controls are extremely accurate, sensitive and dependable. They provide trouble-free performance, promote economical operation and contribute to enthusiastic user satisfaction.

For further information on Sarcotherm weather-modulated controls, Sarco heating specialties and Sarcofin finned-tube and baseboard radiation, write for catalog.

Sarcotherm Controls, Inc., Empire State Bldg., New York 1, N. Y.

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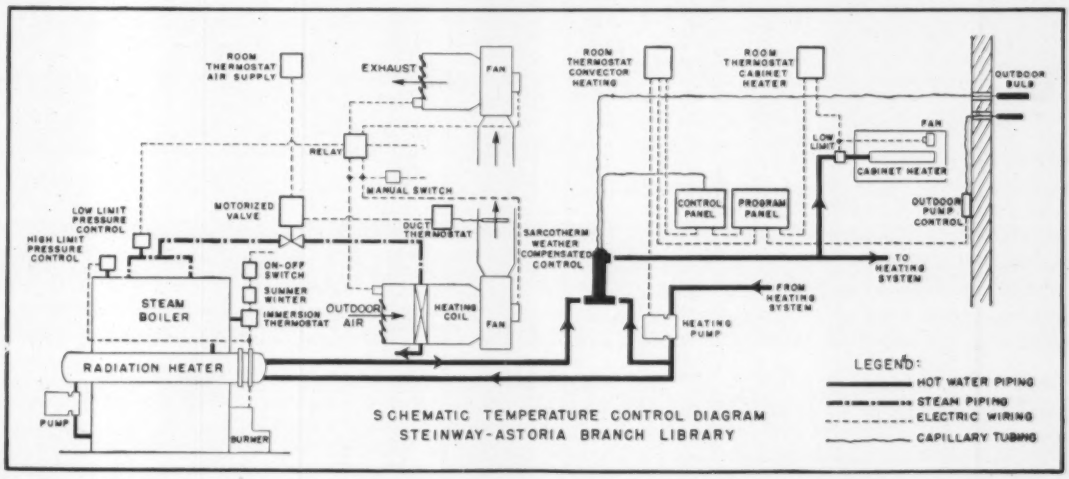
Sarcotherm

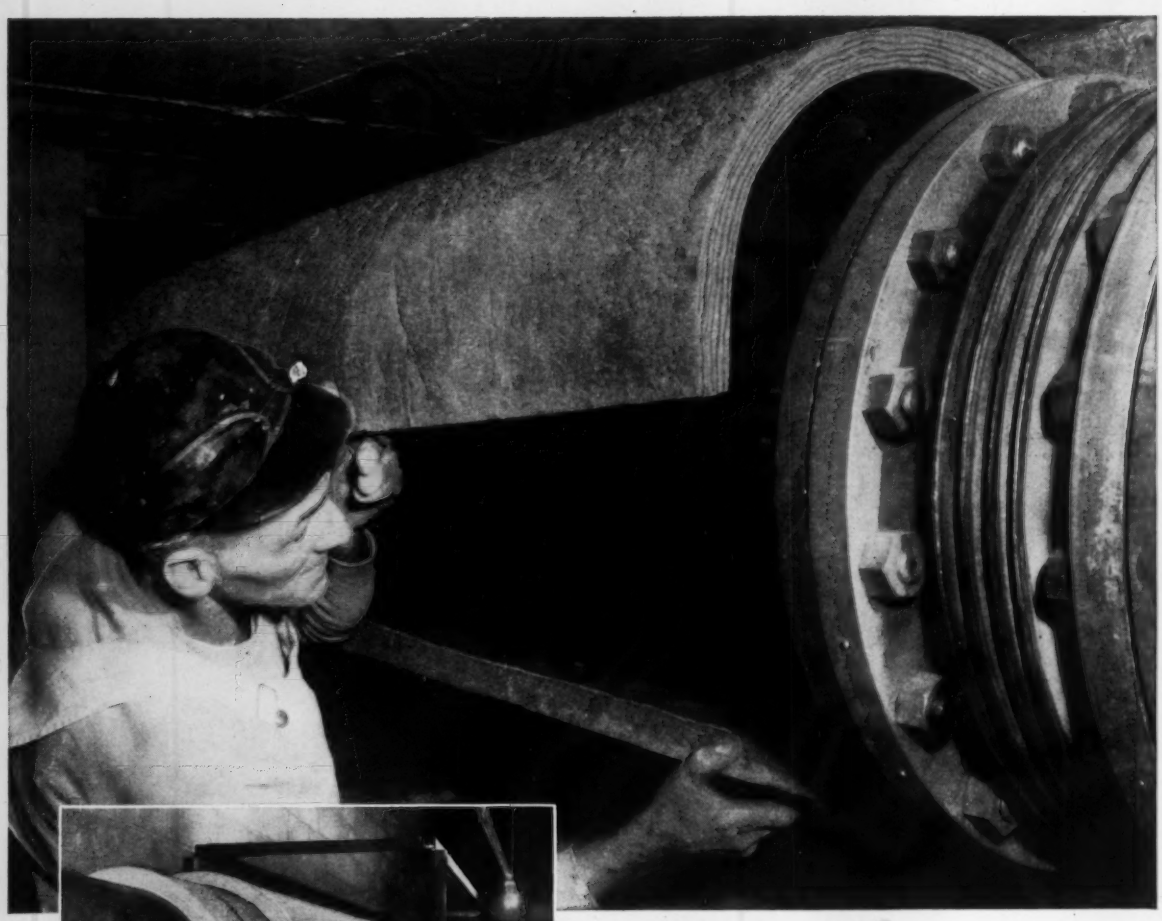
AN AFFILIATE OF *SARCO COMPANY, INC.*

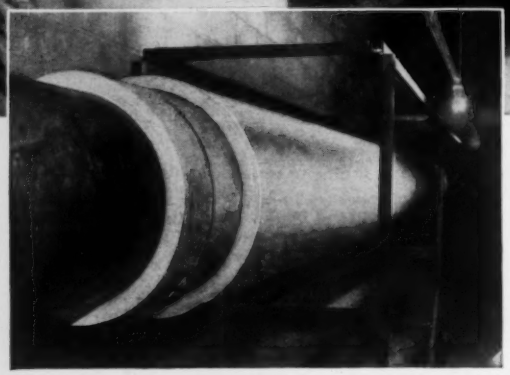
Weather-Compensated Controls for steam, hot water and radiant Heating 4004-B



SCHEMATIC TEMPERATURE CONTROL DIAGRAM
STEINWAY-ASTORIA BRANCH LIBRARY

Architect: Adolph Goldberg, Brooklyn, N. Y. Engineers: V. L. Falotico & Associates, Brooklyn, N. Y. Heating Contractor: H. Sand & Co., New York, N. Y.





SNAP*ON...

the modern, efficient way to insulate pipe

Take a good look at the unique one-piece glass fiber pipe insulation that insulates a 6-foot section of pipe as quick as you can say "Snap*On!" Then picture the savings in your plant when you put Snap*On on large or small, hot or chilled piping.

These on-the-job photos were taken at a midwestern university where large steam distribution lines in tunnels were recently insulated with Snap*On. The job was done in remarkably short time because of the exceptional ease of application. Workmen were pleased to discover that Snap*On weighed only 1/10 to 1/4 as much as conventional insulations — yet was so fibrous-tough that there was no breakage . . . no mess . . . no clean-up time.

An important secondary saving was the heat saving. Tests conducted on the finished job by the university showed the surface temperature of Snap*On to be 50° lower than that recorded on the insulation formerly used!

These are documented facts. The same sort of superior thermal efficiency and low-cost application can be yours if you insulate piping up to 33" in diameter, where temperatures do not exceed 350°. But see for yourself — write today for samples and Technical Bulletin SO-55 today.

GUSTIN-BACON *Manufacturing Company* GUSTIN gb BACON

Thermal and acoustical insulations • Molded glass fiber pipe insulation • Pipe couplings and fittings

220 W. 10th St., Kansas City, Mo.

JENN-AIR—COMPLEMENT TO AN ARCHITECTURAL TRIUMPH—NORTHLAND SHOPPING CENTER

Architect: Victor D. Gruen, Associated Architects and Engineers, Inc., General Contractor: Bryant and Detwiler Co.; Consulting Engineer: H. E. Beyster and Associates, Inc.; Mechanical Contractor: Donald Miller Company

J. L. Hudson Company streamlined store serves as the focal point of Northland Center

Low Contour Exhausters meet functional and aesthetic demands... provide fresh air for comfort—blend with building design concept.

A blending of aesthetics and functional performance plus accent on customer comfort . . . that is a quick description of Northland Center, suburban Detroit.

Take ventilation. There was need for efficient movement of air . . . carrying off heat from ranges—presses—dryers—the fresh'ning of toilet areas. That was the functional aspect. But ventilators had to blend with the architectural concept, holding an uninterrupted sweep to roof lines. On all counts Jenn-Air Exhausters met the test:

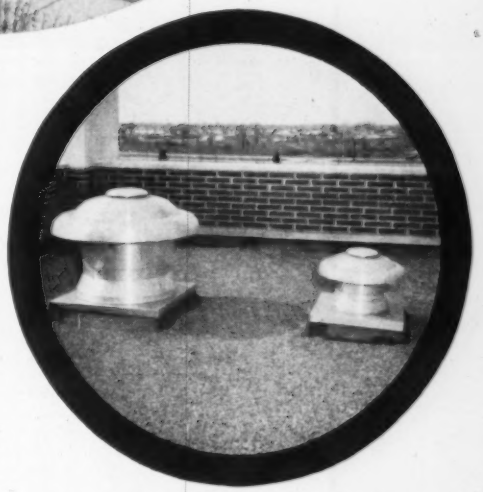
True low contour design that hugs the roof, complementing the modern architectural motif;

Efficient noiseless operation with full ball bearing grease packed motor guaranteed for 10 years uninterrupted service;

Easy installation—bolted directly to the roof—no louvres or unsightly penthouse necessary;

Made of ageless aluminum—built to outlast any structure.

On your next building project consult Jenn-Air Ventilating Specialists in the pre-planning stage.



Here is a typical installation of two Low Contour Jenn-Air Exhausters on the roof of J. L. Hudson Co. Store in Northland Center. The Large Unit Model 161-CR is connected to five canopies over steam presses. The small Exhauster, Model 90-CR, carries away heat from dryers.

JENN-AIR PRODUCTS COMPANY, INC.

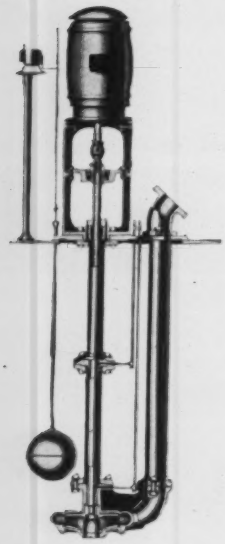
Architects & Builders Building • Indianapolis 4, Indiana

Archie says:—

"No need to look farther for the exact pump to meet an especially tough problem. Yeomans builds a complete line of Vertical Wet Pit Centrifugal Pumps which meet a wide range of requirements. All conform to Yeomans strict standards for dependable, year-in, year-out service and the ability to perform *instantly* when called upon, — all are covered by Yeomans acceptance of full responsibility for satisfactory operation when installed as recommended."

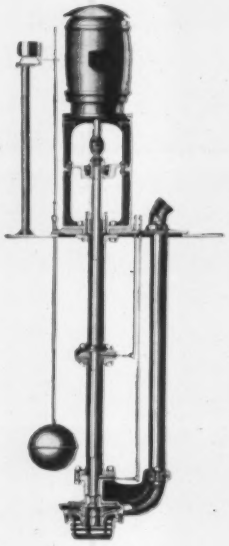
YEOMANS

VERTICAL WET PIT CENTRIFUGAL PUMPS



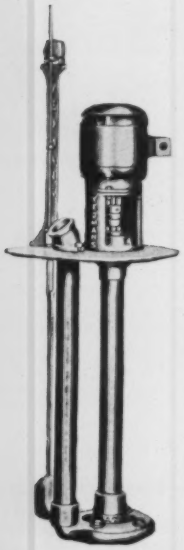
SERIES 8000 HEAVY DUTY SCREENLESS EJECTORS for liquids containing solids, dirt and trash; for heavy liquids, storm drainage and industrial uses. Smallest units pass 2½" solids.

Heavy, close-grained cast iron pump casing streamlined to flow. LUBRI-VAC® Lubricating System consisting of specially designed repelling vanes and lubricating lines to bearing and lubricant eliminates scoring of radial bearing. High carbon piston steel shaft, turned, ground and polished; adjustable single row ball thrust bearing; flexible coupling. Pump casing hung from steel suspension plate. Automatic control. Capacities from 75 to 1200 g.p.m.; heads to 70 ft.



SERIES 3000 BILGE OR SUMP PUMP for solids-free liquids from drainage and seepage, sewage effluents and industrial process wastes. LUBRI-VAC® System standard on all units.

A heavy-duty wet pit pump supplied as a complete unit including pump casing, impeller, shaft, suspension and discharge pipes, thrust bearing and flexible coupling assembled on a suspension plate with a catch basin or sump cover, with motor and automatic control equipment. Normally furnished with standard float and stand, but special automatic controls and floats supplied when specified. Gravity or forced feed automatic or non-automatic lubrication as required. Capacities from 15 to 1200 g.p.m.; heads to 75 ft.



SERIES 3100 BILGE OR SUMP PUMP—Top Suction Type-for homes, residential buildings, industrial plants, sewage and water treatment plants, recreation parks, pools, and similar applications.

Meets the need for a moderate price pump of heavy duty construction for capacities to 120 g.p.m. and heads to 46 ft. Designed and built to Yeomans strict engineering standards with self-adjusting flexible coupling, liberal size stainless steel true running shaft, renewable sleeve guide bearings and bronze impeller with large water passages, balanced hydraulically and mechanically. Duplex sets with interchanger which divides the work between pumps is recommended for longer life and emergency use.

"Drain-Dri" Sump Pump
for buildings and industrial use.

Built like a heavy-duty Yeomans municipal Pump. Hard finish, balanced, non-clogging impeller passes matches, laundry waste and basement trash. Large area, heavy cast iron screen will not bend or get out of shape to destroy its effectiveness. Extra large stainless steel shaft. Permanently aligned drip-proof ball bearing motor, 1750 r.p.m. 60 cycle, or 1450 r.p.m. 50 cycle can be supplied with diving bell for rugged underground duty. Sump depths from 2 ft. to 10 ft. Capacities to 85 g.p.m., heads to 30 ft.

Contact your local Yeomans representative listed in the Yellow Pages of your telephone book under "pumps", or write direct to factory.

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YEOMANS BROTHERS CO.
2000-5 No. Ruby Street,
Melrose Park, Ill.

POWELL VALVES . . . THE COMPLETE QUALITY LINE . . . POWELL VALVES

. . . THE COMPLETE QUALITY LINE . . . POWELL VALVES . . . THE COMPLETE QUALITY LINE . . .

POWELL VALVES FOR MODERN INDUSTRY

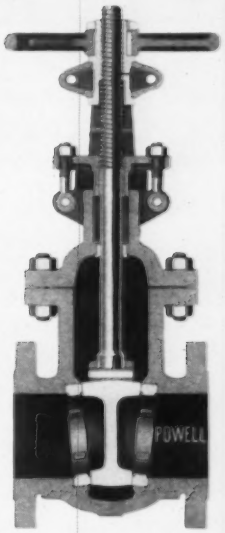


FIG. 1503 (sectional) —150-Pound Steel Gate Valve

FIG. 1793—Iron Body Bronze Mounted Gate Valve for 125 Pounds W.S.P

FIG. 500—Bronze Screwed-in Bonnet Gate Valve for 125 Pounds W.S.P.

FIG. 2608—Bronze "W.S." Full Flow Globe Valve for 200 Pounds W.S.P.

. . . THE COMPLETE QUALITY LINE . . . POWELL VALVES . . . THE COMPLETE QUALITY LINE . . .

POWELL VALVES . . . THE COMPLETE QUALITY LINE . . . POWELL VALVES

When you think of valves—think of Powell. For Powell's is the *complete* quality line. Powell probably makes more kinds of valves and has solved more valve problems than any other organization in the world.

Shown above are just a few Powell Valves. Investigate these valves . . . *and* the *complete* line of quality valves that have a proven record of long and dependable service.

Consult your Powell Valve distributor. If none is near you, we'll be pleased to tell you about our complete line, and help you solve any flow control problem you may have. Write . . .

The Wm. Powell Company, Cincinnati 22, Ohio . . . . . 109th year

HM THE ONLY Matched

COOLING TOWERS and CONDENSERS

The Halstead & Mitchell Cooling Towers you select are *matched* by design to work with the famous Halstead & Mitchell water-cooled Condensers. You need no longer buy a high-efficiency cooling tower to work with a low-efficiency condenser (or *vice-versa*) . . . a long-life cooling tower to work with a short-life condenser (or *vice-versa*).

Remember that every cooling tower you sell is planned to work with a water-cooled condenser—then you'll see why America's leading manufacturers of air-conditioning and refrigeration equipment have swung to Halstead & Mitchell for their original equipment needs in both these components.

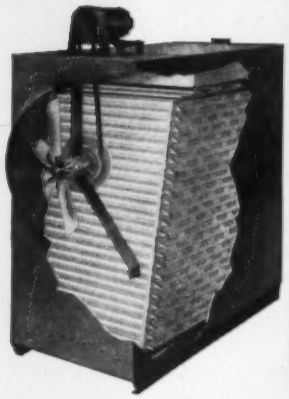
With cleanability you'll sell more. Why sell less?

20-Year Guarantee!

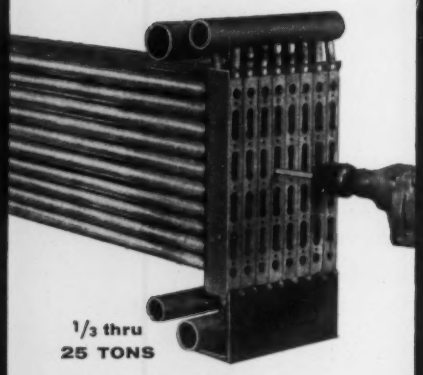
on the wetted deck surface against rotting or fungus attack

Only Halstead & Mitchell pressure-creosoting can provide a *guarantee* against immediate attack by fungus and marine parasites . . . or chemical deterioration from acids in water.

Added to this H&M exclusive are other major advantages. There's ultra-high efficiency in the gravity-type water distributing pan which eliminates extra pumping head required on spray type towers . . . and cuts down on water losses due to "atomizing" of water. And there's extra-long life in stainless steel fans . . . and sheet steel cabinets hydraulically painted with vinsynite, vinyl zinc and chlorinated rubber.



2 thru 120 TONS



1/3 thru 25 TONS

Lifetime Cleanability

The *mechanical* cleaning of H&M double-tube, counter-flow condensers means the simplest, least dangerous method of restoring new unit efficiency. Whether removing a heavy coating of sludge and scale, or a thin insulating film on the inner walls of the copper tubing, the mechanical cleaning tool restores heat transfer efficiency in a matter of minutes. The result is lowered discharge pressures . . . more heat carried off by cooling water . . . lower bills. *Only* the impurities are removed . . . the thickness of the copper wall remains intact, and the condenser gives extra years of peak service.

At Leading Heating and Refrigeration Wholesalers *EVERYWHERE*

Write for Detailed Specifications

HM Halstead & Mitchell

BESSEMER BUILDING • PITTSBURGH 22, PA.

SAVES 50% ON CLEAN AIR MAINTENANCE COSTS!

THE FIRST TOTALLY NEW FILTER DEVELOPMENT . . . IN 25 YEARS

*This is not an idle claim . . . it's a fact . . . PROVEN UNDER ACTUAL INSTALLATION AND MAINTENANCE CONDITIONS.

Make no mistake about it . . . no matter *how small* your filter requirements . . . or *how large*, here is a completely new air filter development *that can absolutely cut your clean air maintenance costs in half.*

NO HEAVY TENSION OIL — Evans filters do not have a messy, sticky type of adhesive that is filthy to handle and difficult to clean. It is unnecessary and is forbidden in the use of Evans filters.

CLEAN WITH TAP WATER — Evans filters can be cleaned clean in minutes with nothing ever but tap water sprayed through an ordinary garden hose nozzle. They require no expensive fireproof room. No caustic cleaning solutions or agents. This eliminates all danger in the cleaning of Evans filters.

LIGHT WEIGHT CUT LABOR COSTS — Evans filters are all aluminum. Light to handle, to carry, to pick up. In spite of airtight fitting frames, Evans filters pull quickly and easily in and out of the frames. Take much less effort, less labor to handle. No latches . . . or lugs *required.*

REMEMBER: Initial costs for air cleaning equipment are not the big factors or controlling factors in the cost for clean air.

IT'S OPERATING COSTS THAT YOU MUST LIVE WITH AND THAT YOU MUST CONTROL.

EVANS FILTERS GIVE YOU THAT CONTROL. MAKE IT POSSIBLE FOR YOU TO SAVE 50% ON CLEAN AIR MAINTENANCE COSTS.

- ALL ALUMINUM
- EVERY PART PRECISION MADE
- HOLD UP TO 200% MORE DUST
- AND LINT WITHOUT HARMFUL RESTRICTION TO AIRFLOW
- GIVES LIFETIME SERVICE

FREE CATALOG

MAIL COUPON TODAY

THE GEORGE EVANS CORPORATION · MOLINE, ILLINOIS

Gentlemen: I wish to know how to cut my clean air maintenance costs in half with a filter that gives lifetime service. Please send me new illustrated catalog.

Name .....

Company .....

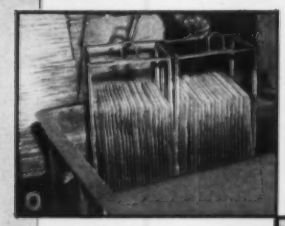
Address .....

City ..... State .....

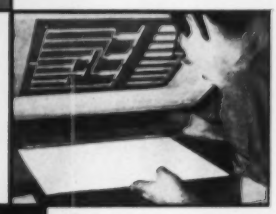
Evans

Lifelong AIR FILTERS

8 STEPS TO A REFRIGERATION REVOLUTION



1. Two sheets of metal are trimmed to a size which will give the proper dimensions. Plates are thoroughly cleaned before silk screen process.



2. The desired pattern is then silk screened on one of the sheets. A special stop weld ink is used to prevent bonding in pattern.

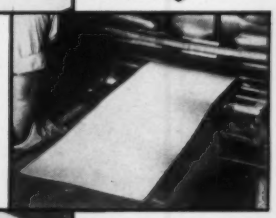
3. The next step is to weld the two sheets together to hold them during the rolling process.

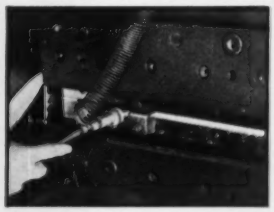
4. The union of the two pieces begins with the hot rolling. The two sheets are on the way to becoming a single homogeneous piece.

5. In the cold roll that follows, the metal reaches its final length dimension. The pattern inside the sheet is complete and ready for inflation.

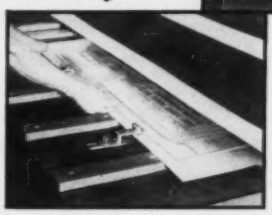
6. Water pressure is then applied at the point where the stop weld material reaches the edge of the sheet. In an instant, the internal design is raised.

Rolling off a production line by the thousands, leak-proof Western Roll-Bond evaporators have created a revolution in the manufacture of refrigerators. Now, a single sheet containing the entire tubing design *inside the metal itself* does the job formerly done by a maze of tubes and low conductivity welds. By using Western roll-bonding, tubing designs can be changed in a matter of days—die costs eliminated—leaks done away with forever. Other refrigerator manufacturers have changed over or are in the process of doing so—why don't you call or write today for more information on the Western roll-bonding that is setting the future pattern for an entire industry.

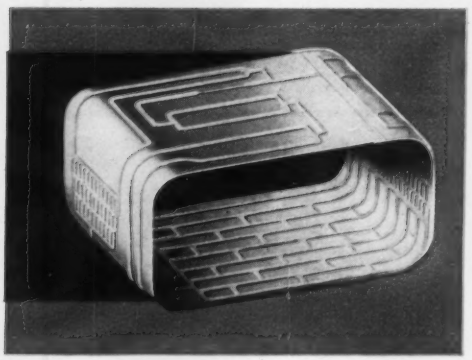




7. After washing and cleansing, the final step is trimming to correct size. It is then inspected for accurate dimensions.



FREE! *Actual Sample of Western Roll-Bond Process Metal. Management, Engineering and Production men frequently ask for an actual piece of Western Roll-Bond Process Metal. Western will be happy to supply samples on request. Write to Roll-Bond Process, Metals Div., Dept. G, East Alton, Ill.*



8. Only the simplest piercing, notching and bending operations remain to be done, and the finished object is ready for final assembly.

Western ROLL-BOND
TRADE-MARK

metals division

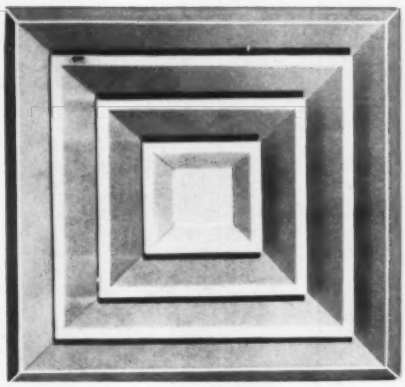
OLIN MATHIESON CHEMICAL CORPORATION

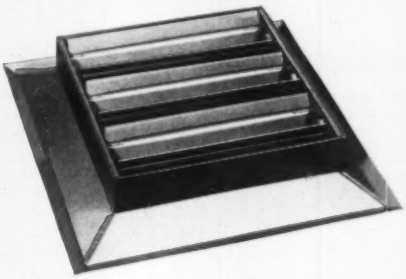
EAST ALTON, ILLINOIS

NEW!... AT CARNES

1-2-3-4 WAY AND 2-WAY CORNER SQUARE AND RECTANGULAR

CEILING DIFFUSERS





MODELS SFS AND SFR

Here is a new line of square and rectangular diffusers, by Carnes. Models SFS (surface-mounted) and SFR (for recessed ceilings)—are scientifically and artistically designed with the corner air scoop on the back side of the deflecting vanes to assure a 360° air distribution pattern. The 4-way blow diffuser, illustrated at the left, is an example of the attractive, symmetrical appearance of this new line—an improved and re-designed selection of diffusers that features extremely easy installation . . . sturdy construction . . . maximum efficiency . . . extremely quiet operation . . . attractive prices. And—the wide variety of blows makes blank-off baffles unnecessary.

MODEL IVS SQUARE AND RECTANGULAR DIFFUSER DAMPER

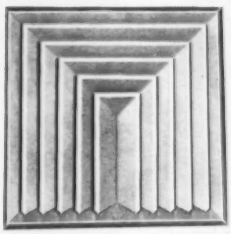
This opposed blade damper, when installed directly to the ceiling plate becomes an integral part of the diffuser. These three simple steps completely install Carnes square and rectangular diffusers and dampers:

1. Attach ceiling plate to duct with sheet metal screws.
2. Insert damper and attach to ceiling plate with four sheet metal screws.
3. Snap inner vane assembly into place—no screws or tools necessary—this assembly is held in place by spring catches.

Only a few minutes for the complete installation—and the damper is completely adjustable from the face of the diffuser—simplifying balancing.

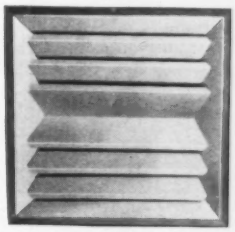
AVAILABLE IN ALL AIR DISTRIBUTION PATTERNS

3-WAY



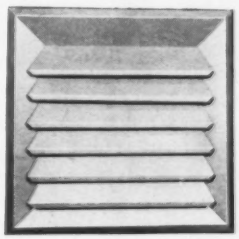
SFS-3 and SFR-3-deliver an equal portion of air evenly in three directions.

2-WAY



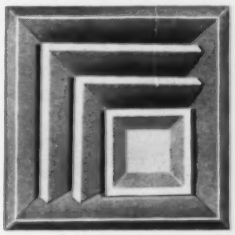
SFS-2 and SFR-2-ideal for long rooms and corridors.

1-WAY



SFS-1 and SFR-1-in all sizes, available with vanes running in either direction.

2-WAY CORNER



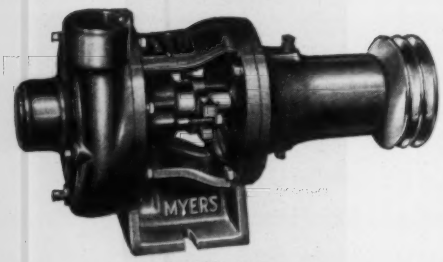
SFS-2C and SFR-2C- for room or corridor corners where right angle blows are necessary.

FOR COMPLETE INFORMATION, WRITE

CARNES CORP.

Verona, Wisconsin

MODEL 100-B
Rotary seal only



MODEL 125-B
Shown with stuffing box
(available with rotary seal)

MODEL 100-M
Rotary seal only

MODEL 125-M
Shown with stuffing box
(available with rotary seal)

A Complete Line of Centrifugals for Air Conditioning from

MYERS

tops in pumps since 1870

FULL RANGE OF SIZES
⅓, ½, ¾, 1, 1½, 2, and 3 horsepower, motor-mounted or belt-driven models.

TWO CASING SIZES
1″ x 1¼″ or 1¼″ x 1½″.

ALL-BRONZE IMPELLER
Accurately balanced for smooth operation.

REMOVABLE BRONZE WEARING RINGS
Easily replaced for longer pump life.

ROTARY SEAL
Eliminates leakage (stuffing box may be specified on "125" models).

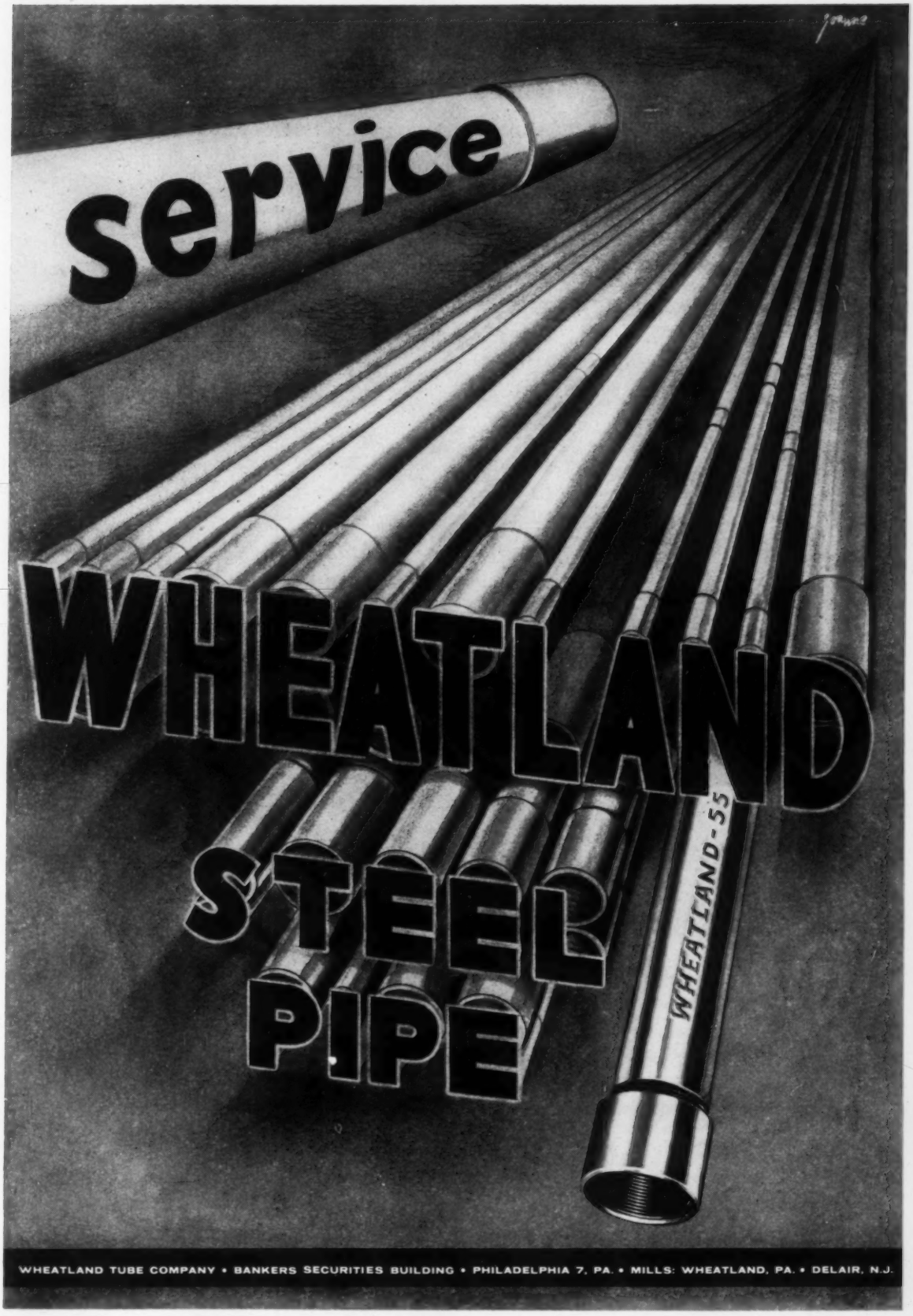
CORROSION-RESISTANT SHAFT
Stainless steel for trouble-free service.

WIDE RANGE OF CAPACITIES AND HEADS
Capacities to 90 GPM. Heads to 135 feet.

Write today *for Bulletin 210 on* Myers *Centri-Thrift Pumps.*

Myers **PUMPS** WATER SYSTEMS AND WATER SOFTENERS

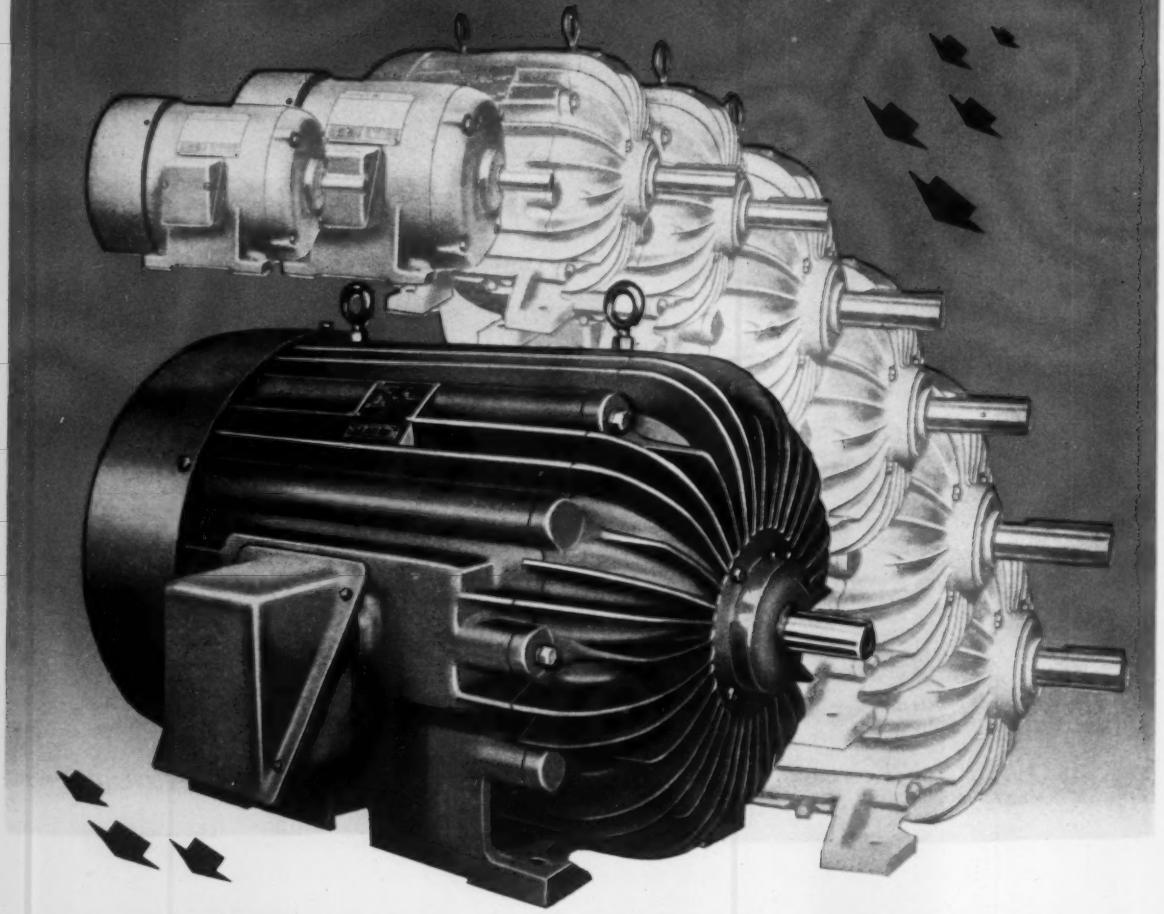
The F. E. Myers & Bro. Co., Dept. HP-9, Ashland, Ohio


service
WHEATLAND
STEEL
PIPE
WHEATLAND-55
WHEATLAND TUBE COMPANY • BANKERS SECURITIES BUILDING • PHILADELPHIA 7, PA. • MILLS: WHEATLAND, PA. • DELAIR, N.J.

COMPLETE LINE OF...

TOTALLY ENCLOSED MOTORS

DESIGNED FOR MODERN INDUSTRY



COMPLETE RANGE IN FRAME SIZES 56 thru 680

For the Whole Story
Write for ME Bulletin No. 158

Totally Enclosed Non-Ventilated
Totally Enclosed Fan Cooled
Totally Enclosed Forced Ventilated
UL Listed Explosion Proof

MARATHON ELECTRIC DESIGNS AND MANUFACTURES
MOTORS - $\frac{1}{20}$ - TO - 2500 HP • GENERATORS - $\frac{1}{2}$ - TO - 2000 KW

SINCE 1913

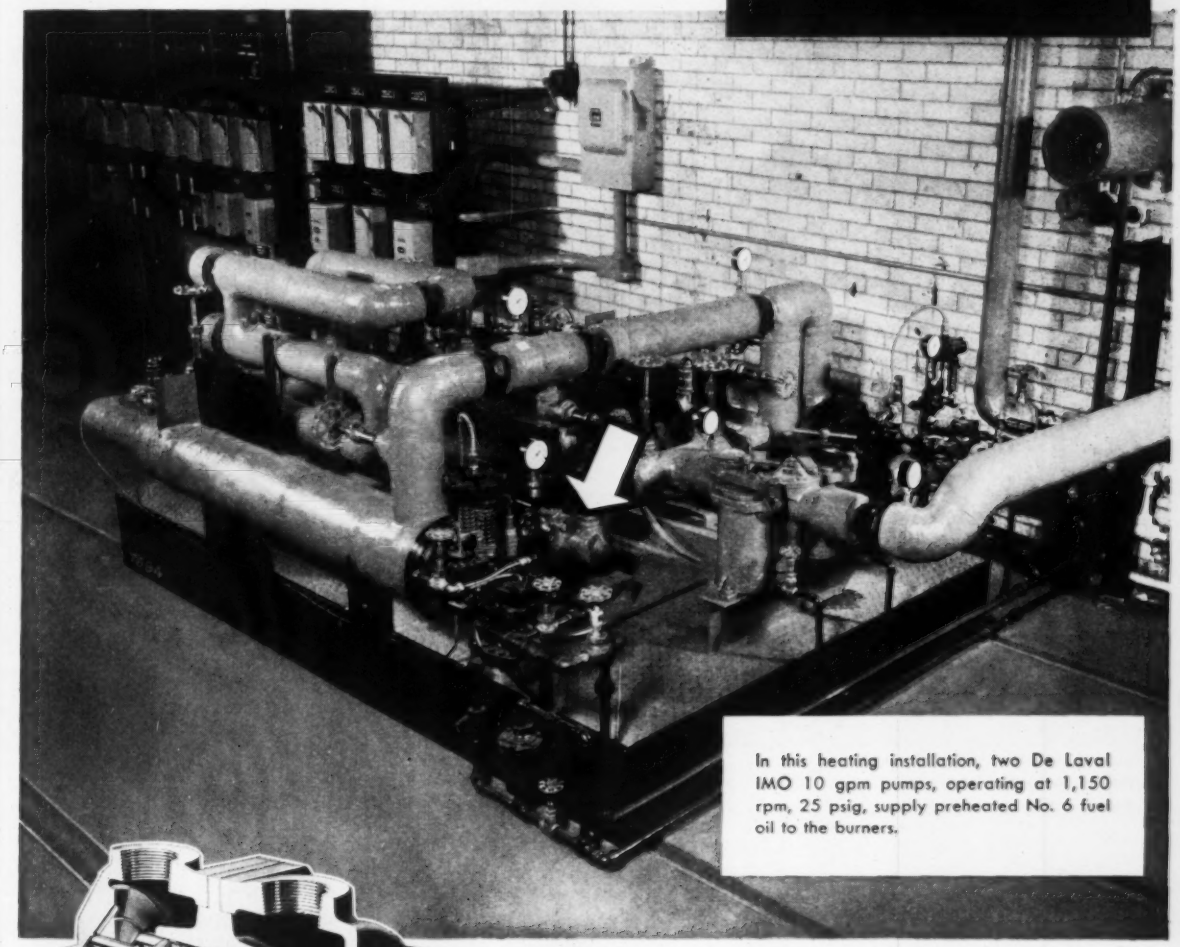
MARATHON ELECTRIC

HOME OFFICE AND FACTORY, WAUSAU, WIS. FACTORIES AT ERIE, PA. AND EARLVILLE, ILL.

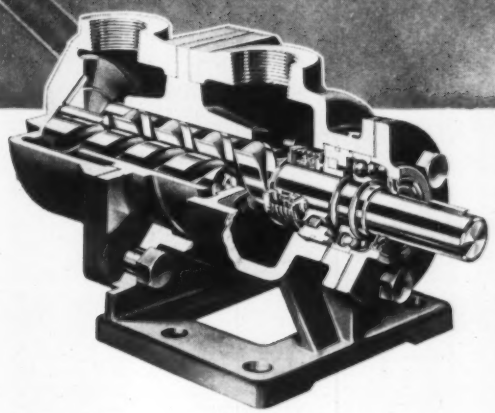
SALES OFFICES IN PRINCIPAL CITIES

Contracts are more profitable when you install dependable

DE LAVAL
IMO PUMPS



In this heating installation, two De Laval IMO 10 gpm pumps, operating at 1,150 rpm, 25 psig, supply preheated No. 6 fuel oil to the burners.



A wide range of De Laval IMO models specifically built for fuel oil service is available. Capacities up to 80 gpm, pressures to 275 psig. Write today for Bulletin LG-A.

To increase your present—and future—profits on commercial heating jobs, install *dependable* De Laval IMO pumps on pump and heater sets. Their simple, trouble-free design saves you money on service calls . . . builds customer goodwill, for there's nothing to get out of order or need adjustment. No pilot gears, no sliding vanes, no reciprocating pistons. De Laval IMO's have only three moving parts—smoothly intermeshing rotors that propel the fluid axially in a steady flow without churning, pocketing or pulsation.

DE LAVAL *IMO Pumps*

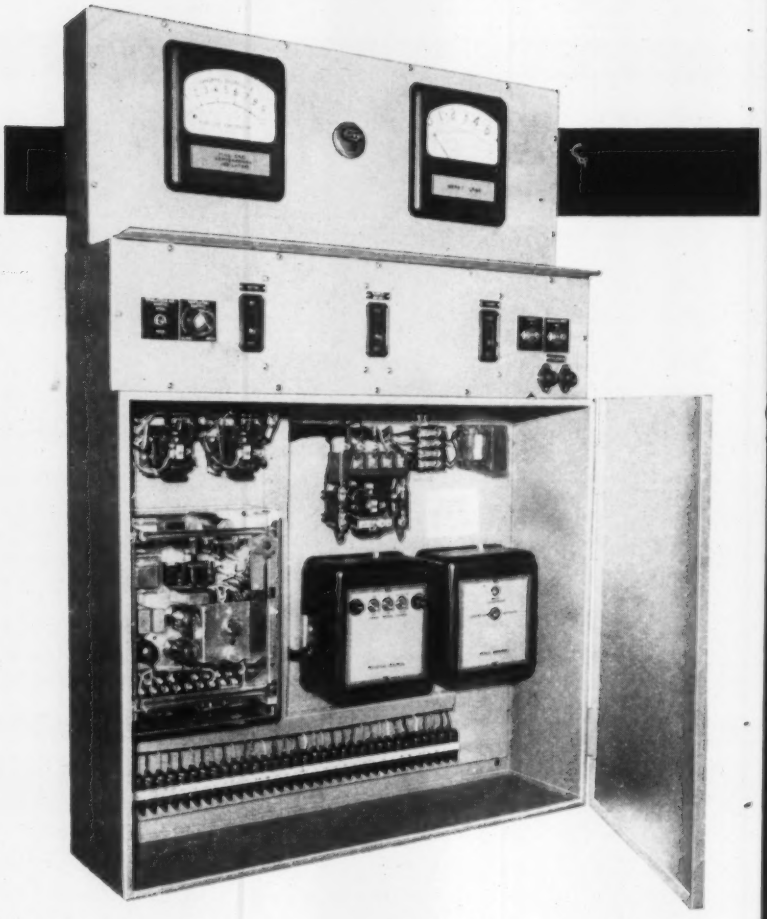
DE LAVAL STEAM TURBINE COMPANY

871 Nottingham Way, Trenton 2, New Jersey

DL272

ANNOUNCING ANOTHER

NEW Line of "Packaged" Control Systems for Automatic Burners



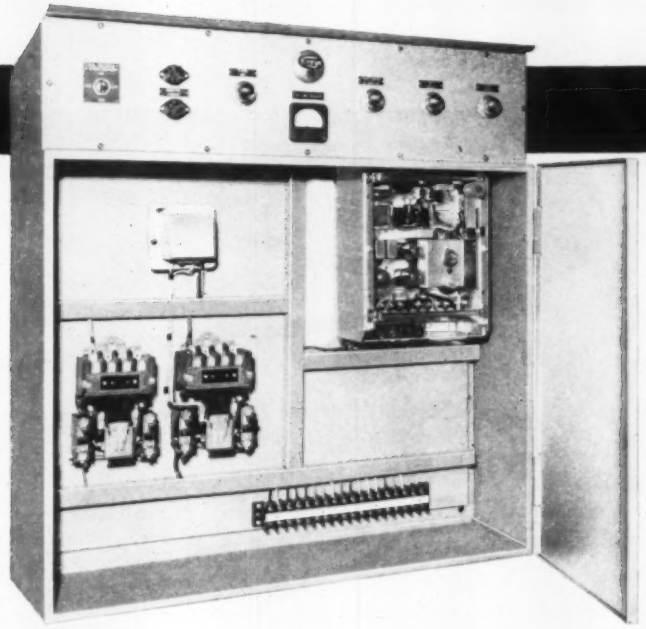
You get Fireye Flame Failure Protection plus complete automatic programming in a single integrated unit.

Assembled and tested by factory experts to minimize installation time and costs, and assure dependable performance.

SAY GOODBYE to wiring problems! With these new factory-wired control systems, Fireye has licked one of your costliest installation headaches. In one "package" you get everything you need. All you do is make a few simple connections to a labeled terminal strip (instead of wiring countless individual components) and your job is done. No chance for wrong wiring, poor connections, or time-consuming "confusion". Your men get jobs done faster . . . your costs are lowered . . . your customers are assured of trouble-free control systems, factory-tested and approved.

In offering these new systems, Fireye fulfills a need for "standardization" of wiring practices that has resulted from the increased use of burners arranged for automatic ignition and programming. Fireye engineers with their broad knowledge of the burner industry's requirements were in an ideal position to assume this responsibility. Again you have proof that Fireye is First and Foremost in modern combustion safeguards! Send for literature.

fireye FIRST

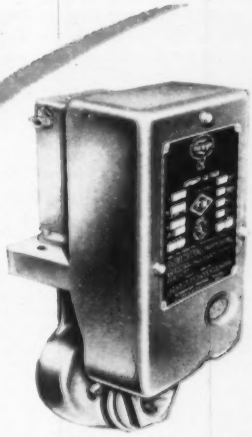


IN A SINGLE UNIT YOU GET EVERYTHING YOU NEED—

Fireye primary controls, short-circuit protection, motor starters, fuel selector switches, signal lights. Also, any needed optional equipment such as sequence draft controls, draft and temperature indicators.

NEW fireye Automatic Gas Valve

AT LAST — a positive action automatic gas shut-off valve! Exclusive shearing action assures positive closure even if pipe scale or welding beads lodge on the valve seat. Also, exclusive double safety release feature assures reliability of closure for over a million cycles of operation, without maintenance. Available in packaged Fireye systems . . . or separately.



E A fireye

COMBUSTION CONTROL DIVISION, ELECTRONICS CORPORATION OF AMERICA
Dept. C13-9, 718 Beacon Street, Boston, Mass.
In Canada, write Electronics Corporation of America, Canada (Ltd.) Box 111, 98 Advance Road, Toronto 18

☐ Send literature on Fireye "packaged" control systems for automatic burners.

☐ Send literature on NEW Fireye Automatic Gas Valves.

NAME & TITLE _____

COMPANY _____

ADDRESS _____ CITY _____

WON'T LEAK!

Joints of Chase® Copper Water Tube and Chase® Solder-Joint Fittings mean a radiant heating job that lasts longer!

Because they're strong *solder joints*, the connections you make with Chase Copper Solder-Joint Fittings stay leak-proof *for good!*

And because Chase Copper Water Tube comes in long lengths of 60 to 100 feet, *fewer* fittings are required, installation is faster and easier!

Together, Chase Copper Water Tube and Chase Solder-Joint Fittings mean a *quality* radiant heating installation that will protect your reputation for good work! Both are available from your Chase Wholesaler.

Chase®

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The Nation's Headquarters for Brass & Copper

(†sales office only)

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Atlanta	Cincinnati	Grand Rapids†	Louisville†	New York	St. Louis
Baltimore	Cleveland	Houston	Milwaukee	Philadelphia	San Francisco
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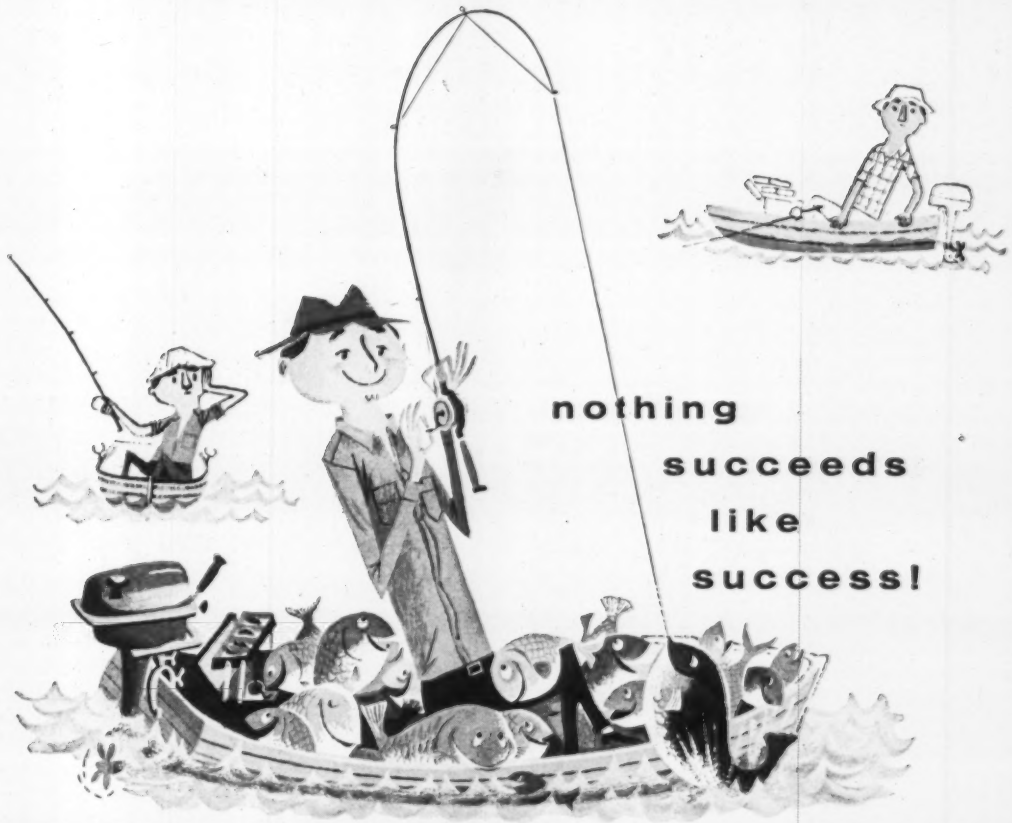
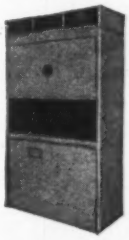
Charlotte†	Denver	Kansas City, Mo.	Newark	Providence	Waterbury



Airtemp Dealers Handle a Complete Line

Packaged Waterless (Air-Cooled) Air Conditioners—no water needed, no plumbing required. 2, 3, 5 and 7½ H.P.

Packaged Water-Cooled Air Conditioners in 6 models, from 2 to 15 H.P.



AIRTEMP'S leadership assures your success!
More Airtemp "Packaged" units have been sold than any other make!

Airtemp pioneered "Packaged" air conditioning 18 years ago. This leadership and experience is bringing greater sales to dealers *today!*

You sell more—because you get continuous help from your Airtemp *Distributor!* As a "Packaged" air conditioning specialist, he's familiar with your problems and can help you solve them *fast!*

You sell more—because you represent the *trusted Chrysler name!* Your customers put their confidence in the high engineering standards of Chrysler Corporation.

You sell more—because you're backed by *powerful merchandising!* Strong national advertising combined with local-level promotion brings in more customers.

You sell more—because of *exclusive Airtemp features!* Special exclusive features give your customers more for their money...and make selling Airtemp easier for you!

For full details on all of the advantages of an Airtemp Packaged Cooling Franchise, write to: Airtemp Division, Chrysler Corporation, Dayton 1, Ohio.

"the line that pays"

Airtemp

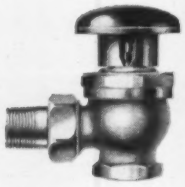
DIVISION OF CHRYSLER

AIR CONDITIONING • HEATING FOR HOMES, BUSINESS AND INDUSTRY

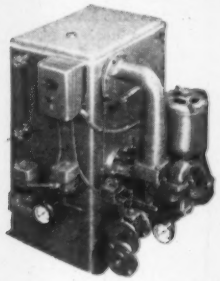
New beauty for along-the-wall

New Thermo Vector painted to simulate wood paneling in office of Mathias Klein, President, Mathias Klein & Sons, Chicago, Ill. Architect: Wright, Martin & Assoc., Wilmette, Ill. Heating Contractor: Fettes, Love & Sieben, Chicago

From radiator traps
to fully engineered systems
you can DEPEND ON DUNHAM for
everything you need in heating

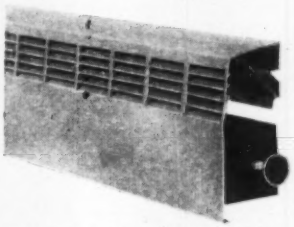


Dunham Radiator Valves. Complete line of radiator valves, traps and other specialties for steam heating.

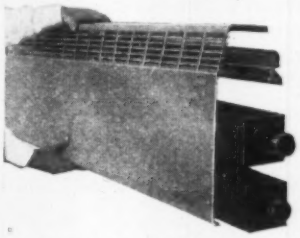


Dunham Vacuum Heating Pumps. Single and Duplex models. No close clearance parts. Only one moving element.

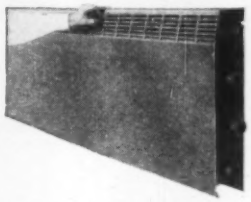
radiation jobs...Dunham Thermo Vector



Here you see the tailored, trim lines of new Thermo Vector.



Here you see how easily new Thermo Vector is installed using "hanging strip."



Here you see the lever-operated damper installed in three tier Thermo Vector.

—with a tailored, trim look

New Dunham Thermo Vector looks good ANYWHERE! Its smooth, unbroken horizontal lines blend beautifully in any office or commercial building . . . and Thermo Vector is sturdy enough to stand up for years and still look good in any industrial or institutional installation.

—with "built-in" versatility

New Dunham Thermo Vector is used flush mounted along the walls . . . one, two or three tiers high . . . with steam or hot water . . . steel or nonferrous elements. Use with full back or just use "hanging strip." Front outlet grille eliminates wall smudging—lets you install Thermo Vector ANYWHERE.

—with cost-cutting ease of installation

To install Dunham Thermo Vector, all you do is position the back or "hanging strip" on wall. Attach element support to it and hang elements. Mount one-piece cabinet . . . then accessories which conceal elements and piping for the "finishing touches." Fronts, backs and lever-operated damper easily cut on the job. For further information, write for Bulletin HPAC-9, C. A. Dunham Company, 400 W. Madison St., Chicago 6, Ill.

DUNHAM®

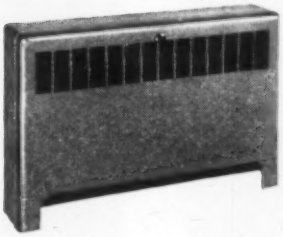
THERMO VECTOR RADIATION

TRADE-MARK

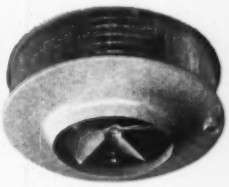
RADIATION • CONTROLS • UNIT HEATERS • PUMPS • SPECIALTIES

Quality First for Over Fifty Years

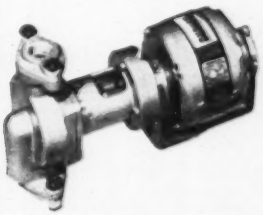
C. A. DUNHAM COMPANY • CHICAGO • TORONTO • LONDON



Dunham Radiation. Full range of sizes and types of convectors, baseboard and finned tube radiation.



Dunham Unit Heaters. Line includes heating-cooling units, vertical, horizontal discharge and large blower unit heaters.



Dunham Circulators. Heart of Dunham's complete hot water line. Single-spring motor coupling. Brand-name motor.

Dunham Vari-Vac®. Precision temperature control system uses continuous-flow "cool" steam, cuts fuel costs up to 40%.

Duriron Acid Resisting Drain Pipe

DURIRON® generally outlasts the building

Specify DURIRON for *permanent* drain lines to handle acids and other severe corrosives. DURIRON is a high silicon iron that is corrosion resistant throughout. It is not a coating. DURIRON is resistant to practically all commercial acids and many other corrosive solutions.

DURIRON has been proved by many years' service in schools, hospitals, laboratories, kitchens, plating rooms, and in many other applications where the economics of good building call for permanent drain lines.

A complete line of DURIRON bell and spigot pipe and fittings is carried in stock by leading wholesalers in principal cities throughout the country. Write for free bulletin PF/4a or see Sweet's Architectural File.

DURIRON is also available with split flange connections for pressure lines. Details are contained in Bulletin PF/2.

THE DURIRON COMPANY, Inc.
DAYTON, OHIO

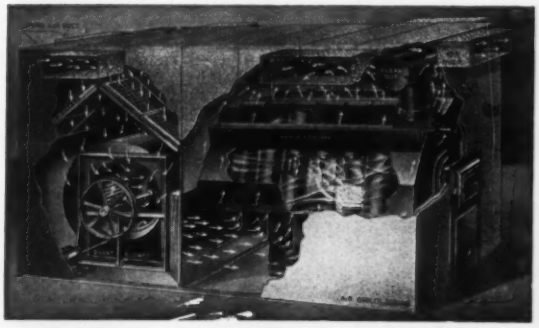
DURIRON
LOOK FOR THE NAME ON EVERY PIECE

WARM AIR HEATED... by Campbell

Westinghouse Electric Corp., Des Moines, Iowa. Heated with a single Campbell 8000 Gas Fired Heater. Installed 1954, by Groves Sheet Metal Co., Des Moines.

PRACTICAL FOR BIG BUILDINGS

More and more architects and contractors are turning to Campbell for practical warm air heating of large buildings. Campbell heaters are low in cost, easy to install. They deliver exceptional fuel economy, and give long, dependable service to assure maximum customer satisfaction. Campbell Heaters are available for all fuels in capacities up to 3,150,000 BTUs. Your inquiry will receive prompt attention.



MANUFACTURERS' AGENTS

We have a number of attractive openings for manufacturers' agents who call on heating contractors and architects. If interested, please state territory you cover.

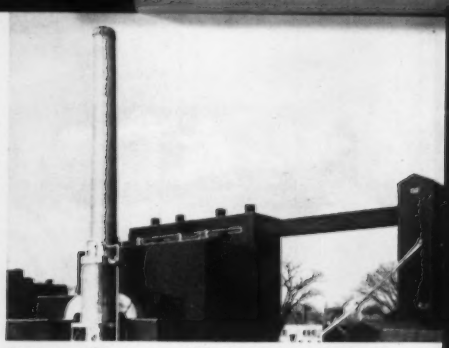
CAMPBELL HEATING CO.
Des Moines 17, Iowa

I am interested in your proposition for manufacturers' agents.
My territory covers.....
NAME.....
ADDRESS.....
CITY.....ZONE.....STATE.....

CAMPBELL HEATING COMPANY
Des Moines 17, Iowa

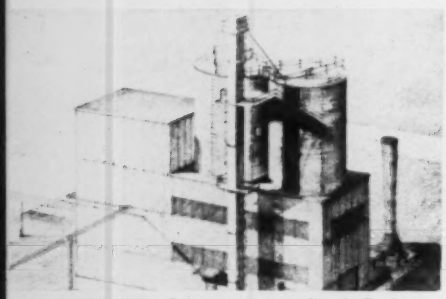
DUPONT'S Barksdale, Wis. Works saves $7,000 a year with new automatic combustion controls.

HUDSON MOTORS' modernized plant in Detroit saves $480,000 a year—cuts powerhouse labor 27%.

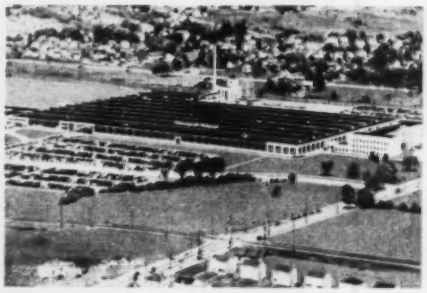


SYRACUSE UNIVERSITY, N. Y., built a completely new unit for maximum economy and dependability.

For efficiency... for economy...



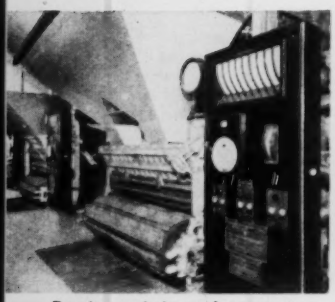
AT STAUFFER CHEMICAL'S new plant in Louisville, Ky., total cost of steam is only 60¢ per 1,000 lbs.



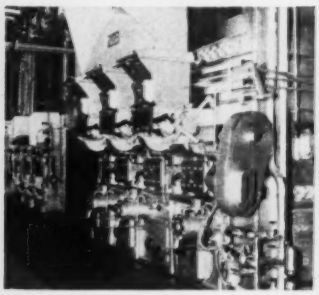
Coal costs 29.6% less than next cheapest fuel at ADDRESSOGRAPH-MULTIGRAPH'S plant in Cleveland.

MOTOR PRODUCTS CORP. of Detroit, Michigan, saves $54,000 a year with modernized installation.

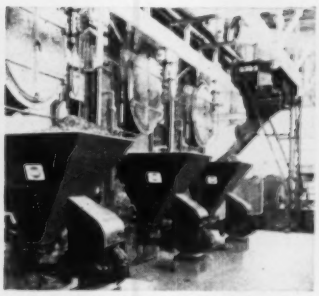
more and more firms



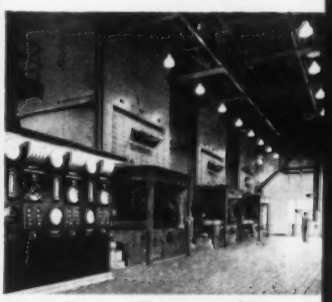
Burning coal the modern way saves PENNSYLVANIA RAILROAD'S, Ft. Wayne, Ind. terminal $33,000 a year.



Efficient new equipment reduces labor and improves performance records for LIGGETT & MYERS at Richmond, Va.



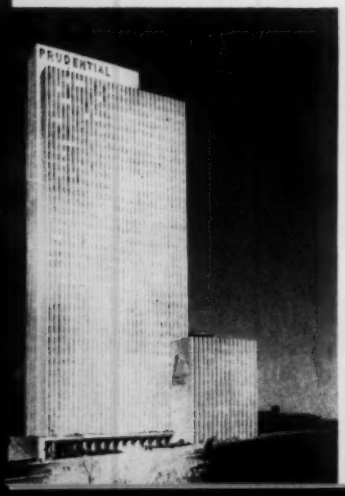
AT LAKEWOOD HOSPITAL, in Lakewood, Ohio, new automatic coal burning facilities cut fuel costs 22%.



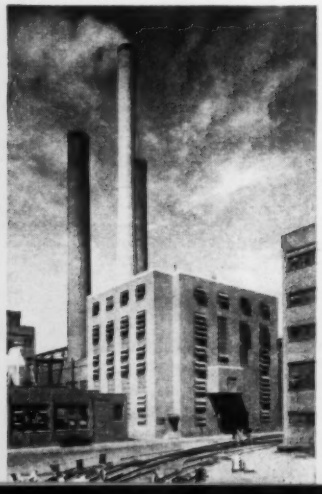
UPJOHN'S new Kalamazoo, Mich. plant is clean and efficient with no dust or smoke nuisances.

are burning coal the modern way

Chicago's ultra-modern PRUDENTIAL BUILDING has fully automatic coal handling and burning system.



GOODYEAR saves $3,000 a day with new coal-burning installation at Akron, Ohio.

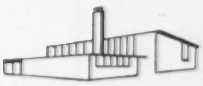


facts you should know about coal

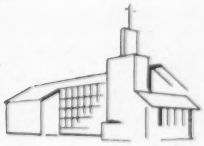
- In most industrial areas, bituminous coal is the lowest-cost fuel available.
- Up-to-date coal burning equipment can give you 10% to 40% more steam per dollar.
- Automatic coal and ash handling systems can cut your labor cost to a minimum.
- Coal is the safest fuel to store and use. No dust or smoke problems when coal is burned with modern equipment.
- Between America's vast coal reserves and mechanized coal production methods, you can count on coal being plentiful and its price remaining stable.

For further information or additional case histories showing how other plants have saved money burning coal, write to the address below.

NATIONAL COAL ASSOCIATION
Southern Building, Washington 5, D. C.



FUEL BUYERS PAY FOR BTU's



RATED at 26,200,000* Btu per ton for bituminous types, *coal* represents one of the greatest sources of latent heat energy, but—

The fact that it is *latent* signifies that this potent source must be developed.

If it is not developed to its fullest potential—if smoke and soot occur, or fuel bed condition results in waste of combustible material—a costly percentage of heat that should have been obtained has been lost.

Will-Burt Automatic, Air-Controlled Stokers assure complete, efficient combustion, not only during operating periods, but during the critical "off" periods as well.

Fuel buyers *get* the Btu's they pay for when it's a Will-Burt Stoker on the job.

...GIVE THEM MORE WITH COAL-FIRED, AIR-CONTROLLED

WILL-BURT STOKERS

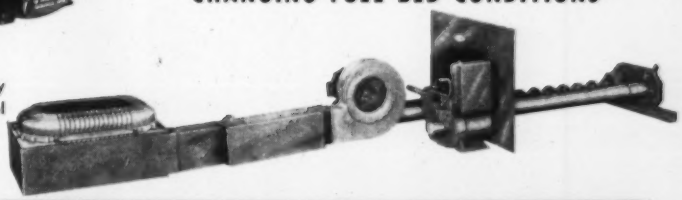
HOPPER MODEL STOKERS—supplied with open or closed type hoppers. Coal burning capacities range from 20 through 750 lbs. per hour.

SMOKE AND SOOT PREVENTED

Automatic Air Control, a "built-in" feature of Will-Burt Stokers adjusts and corrects air admitted to the fire, minute by minute, according to the fuel bed condition. Will-Burt prewired Panel Control Boards provide the necessary full margin of safety.

EFFICIENT COMBUSTION REGARDLESS OF CHANGING FUEL BED CONDITIONS

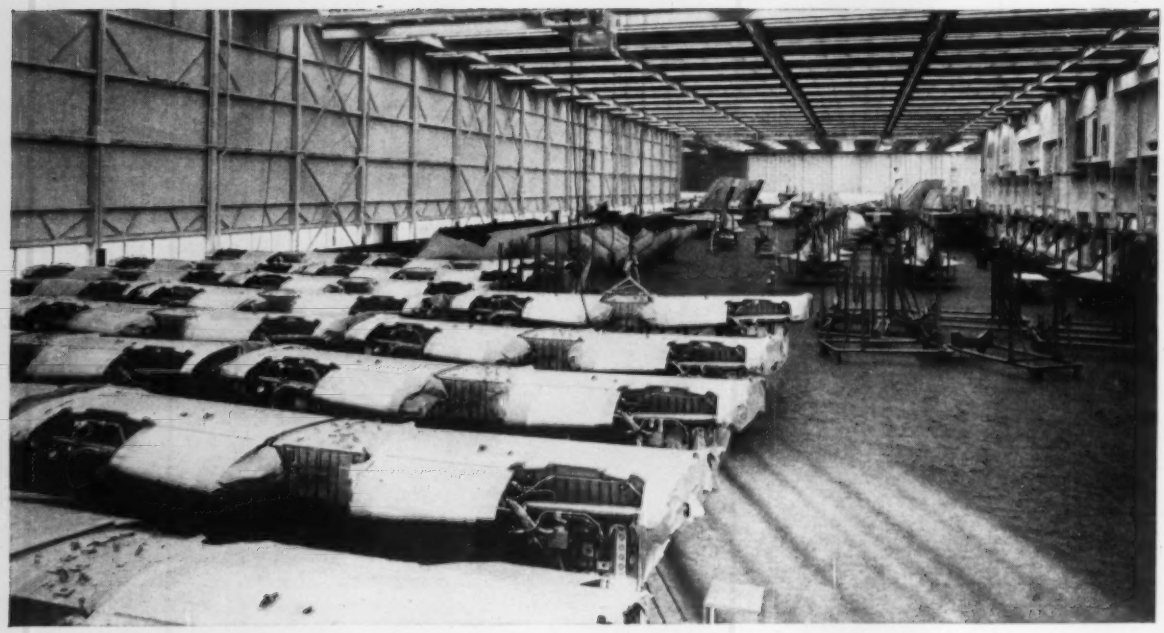
BIN-FED STOKERS—In the same fuel capacity range as hopper models. Automatic Air Control feature included.



Write for manual on stoker-heating, showing suggested specifications and installation diagrams.

The WILL-BURT Company

P.O. BOX 902, ORRVILLE, OHIO



Grumman Peconic River Plant in Calverton. Architects: Office of Alfred Easton Poor; consulting engineers: Seelye Stevenson Value and Knecht and Guy B. Panero; air-conditioning contractors: J. L. Murphy, Inc.—all of New York, N.Y.

Grumman jets are made in a factory *that "breathes"*

New Grumman aircraft plant is completely closed in and soundproofed. American Blower equipment is used to create a controlled, comfort-conditioned indoor climate.

The new Peconic River Plant of the Grumman Aircraft Engineering Corporation, in Calverton, L.I., N.Y., is one of the first aircraft factories built solely for jet assembly and flight operations.

A major designing problem was: how to eliminate the ear-splitting racket of jet engines starting up outdoors—highly distracting to employees involved in intricate manufacturing processes.

The solution: soundproofing—including double-paned, sealed-shut windows. And this posed an air-conditioning problem. For the factory, thus soundproofed, was virtually airtight!

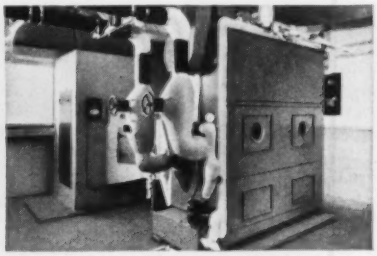
To circulate fresh, conditioned air in a continuous cycle—and to exhaust heat, fumes, and stale air—a comfort-conditioning system was installed that, in effect, resulted in a factory that "breathes". . . a system built around American Blower Supply and Exhaust Fans, Air Conditioning Units, Sprayed Coil Dehumidifiers, Heating and Cooling Coils, Vaneaxial Fans, Venturafin Unit Heaters, and necessary accessories. This gave the Peconic Plant complete humidity and temperature control, providing maximum working comfort and efficiency.

American Blower engineers are familiar with the special air-handling and air-conditioning problems of many industries. For assistance or technical data, contact our nearest U.S. or Canadian branch office.

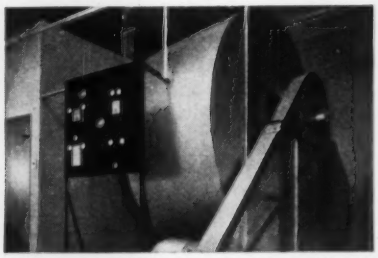
AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO
Division of American Radiator & Standard Sanitary Corporation

AMERICAN BLOWER

Deadly Grumman Cougar thunders over Long Island in test flight. Noise of jet take-offs dictated soundproof plant construction.



Pleasant indoor climate for offices in administration building is created by using American Blower Air-Conditioning Units.



Sixteen powerful American Blower Supply and Exhaust Fans circulate fresh outdoor air; exhaust stale air in continuous cycle.

Why users like Bethcon

We asked a customer why he liked to work with our Bethcon continuously galvanized sheets. The answer came without hesitation:

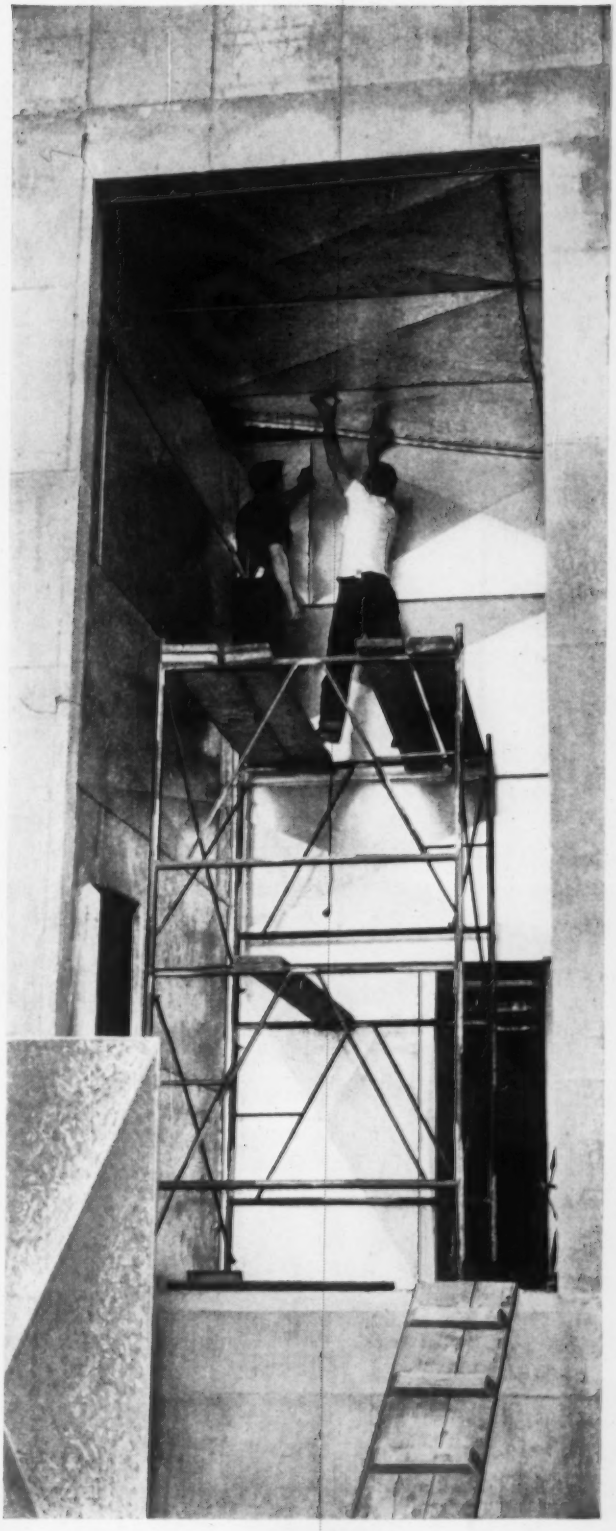
"It's the first galvanized sheet we've found that will take our severe forming operations without flaking or cracking."

That, undoubtedly, is the one most important advantage of Bethcon sheets. Bethlehem's modern continuous galvanizing lines give the steel a coating that adheres much more tightly. In fact, the Bethcon coating is so tight, that even when the sheet is doubled back on itself the coating does not crack or flake off.

But Bethcon has other advantages, too. The coating is more uniform, so that the center and ends of Bethcon sheets get equal coating weight and equal protection. The heavy zinc bead ordinarily found on the drip end of a galvanized sheet is eliminated.

Bethcon is better-looking. The spangles are bright, uniform, attractive in appearance. Sheet-metal contractors find this a helpful sales point to mention.

You can get Bethcon sheets in cut lengths or in coiled strip, 16-gage or lighter. Either plain carbon steel or corrosion-resisting Beth-Cu-Loy (copper-bearing steel) can be used for the base metal, depending on the requirements. For further information, just get in touch with the nearest Bethlehem office.

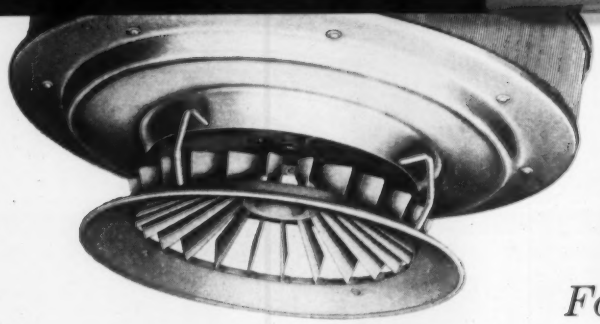


BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL

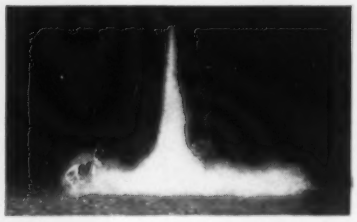
BETHLEHEM STEEL



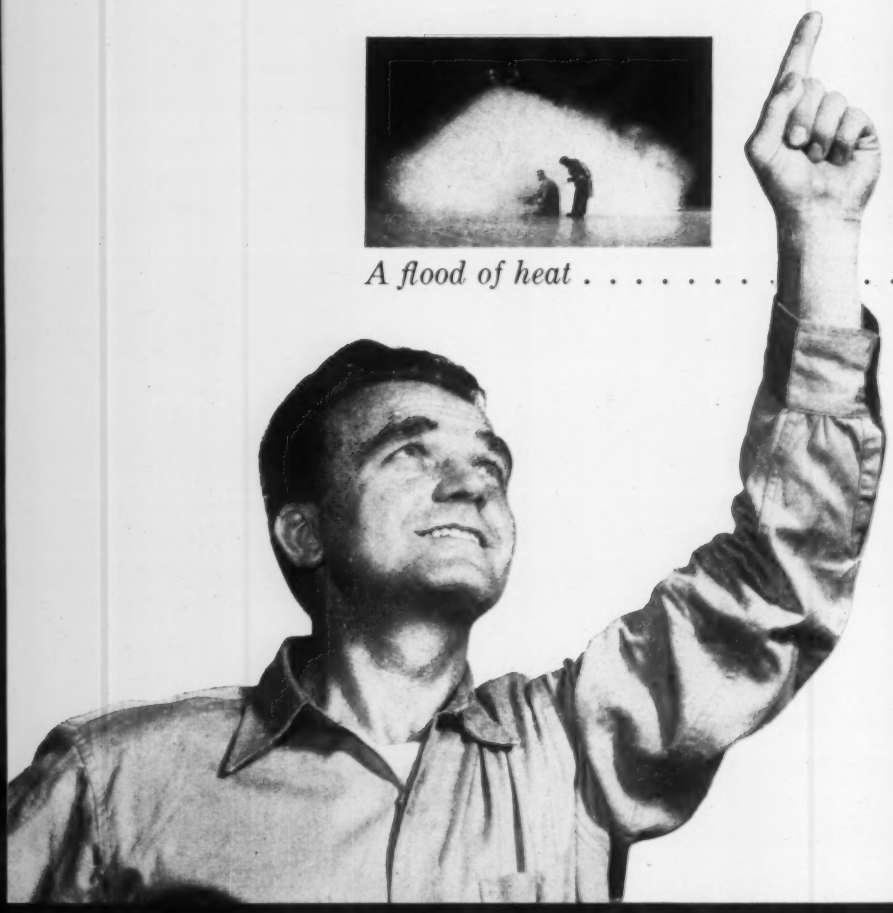
For spot

Solve all your industrial heating

A flood of heat . . . . . .



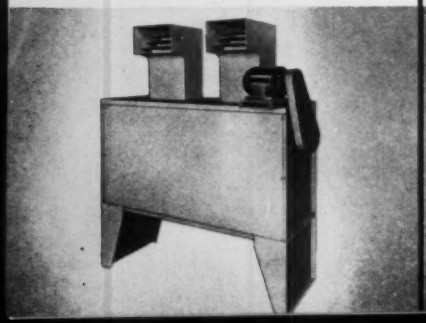
. . . . . or a pinpoint spot.



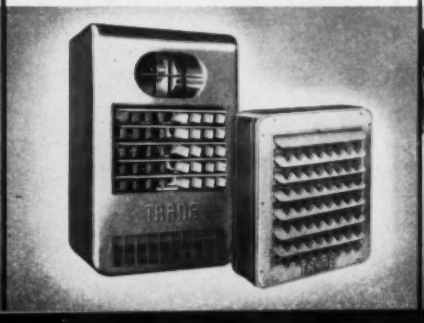
ANY HEATING PATTERN

at any time! Laboratory smoke tests (above) show how TRANE Unit Heaters with exclusive patented Louver Diffusers can direct heat in *any* direction, in *any* proportion—even in *different* directions and proportions at the same time. Unretouched photos prove flexibility of these TRANE units—unequalled by any other unit heater made.

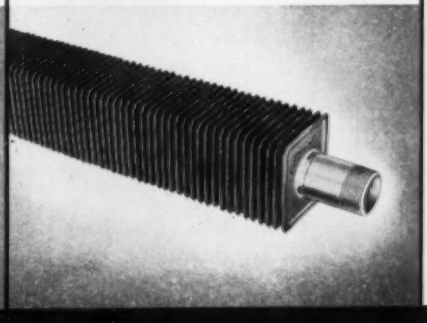
FOR LARGE AREAS, TRANE Torridors have powerful centrifugal fans . . . capacities up to 1½ million Btu's. Use with or without ducts—for heating, ventilating, filtering, process drying.



FOR DOORWAYS, cold walls and general heating—TRANE Horizontal Unit Heaters with exclusive patented Louver Fin Diffusers are a flexible, economical answer. Hot water, steam or gas-fired.



BENEATH WINDOWS and skylights, TRANE Wall-Fin provides low-cost draft protection. May be tiered for extra capacity, installed with expanded metal or heavy gauge steel cabinets.



heating or space heating . . . process or comfort

needs with this one source of supply!

Trane—the industry's most complete line—simplifies selection, installation, maintenance . . . concentrates responsibility!

TRANE PRODUCTS are *matched* products. Designed together, built together—for service together. So there is one source for all the information needed for proper selection, installation, and maintenance. Responsibility is concentrated in *one* reliable source. For the complete details on this *complete line*, see your nearest TRANE Sales Office or write TRANE, La Crosse, Wisconsin.

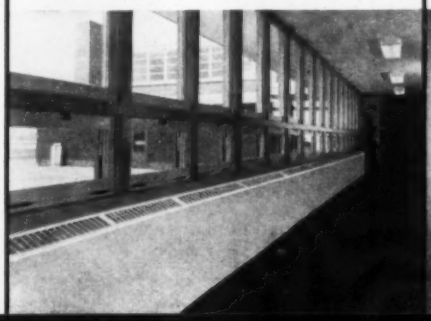
TRANE

MANUFACTURING ENGINEERS

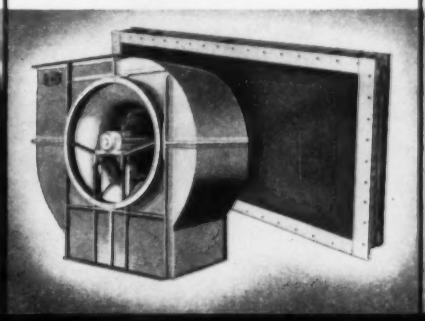
One source, one responsibility for: Air Conditioning Heating · Ventilating · Heat Transfer Equipment

The Trane Company, La Crosse, Wis. • Eastern Mfg. Div., Scranton, Pa. • Trane Co. of Canada, Ltd., Toronto • 90 U.S. and 17 Canadian Offices.

FOR WALL-TO-WALL heating, TRANE Wall Line Convectors combine low initial cost with low installation cost to meet even the tightest heating budgets. Attractive cabinets blend with room.



FOR "BUILT-UP" SYSTEMS, TRANE Fans and Coils are "matched" for service together. Exclusive TRANE features give top efficiency, durability—reduce maintenance to a minimum.

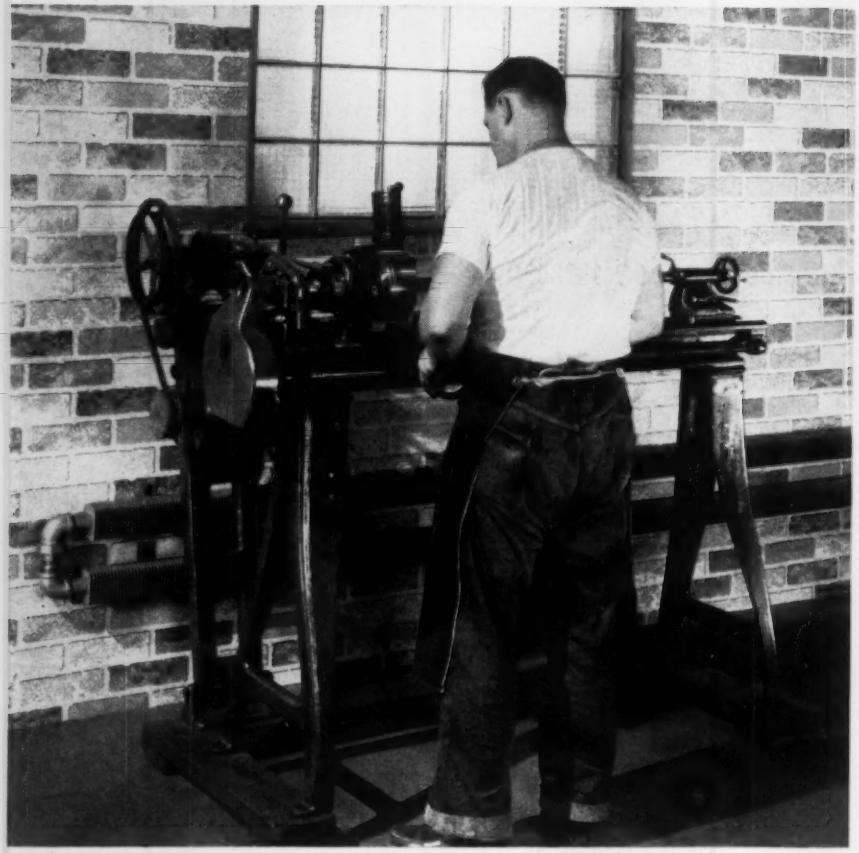


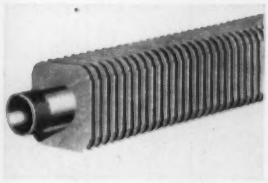
FOR SAVING FUEL, TRANE Radiator, Float, or Bucket Traps, Strainers, Valves and Vents add efficiency, stop waste. For low, medium or high pressure systems in either heating or process applications.

TEMTRIM Finned Tube Radiation

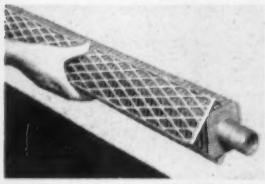
by American-Standard

high output . . . low cost . . . easy installation

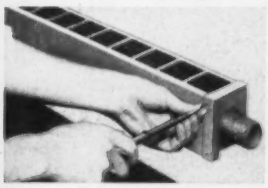




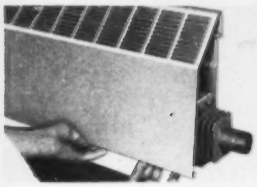
You can install Temtrim with fins exposed . . .



with a snap-on metal grille . . .



a flat top cover or . . .



a sloping top enclosure.

HANG THEM HIGH OR LOW, Temtrim Finned Tube Radiation Units project only 5" into the room—don't steal valuable floor space. They're truly compact, yet they make up one of the most efficient types of radiation ever built.

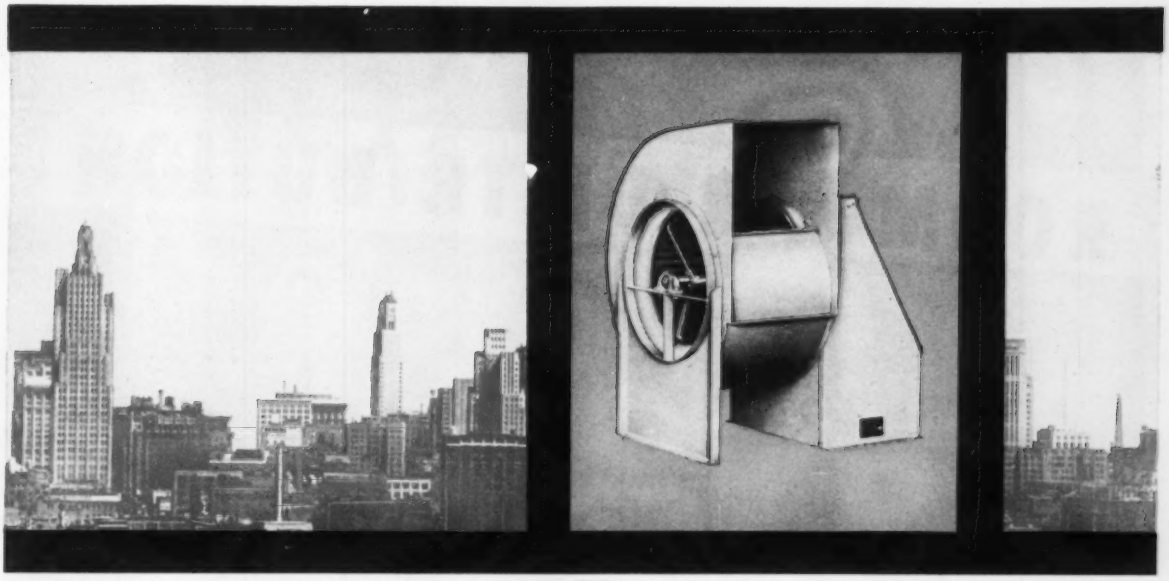
Temtrim is low in cost and easy to install. It can be quickly connected and hung on the wall. Temtrim is fine for buildings old and new, where hot water or steam systems are used.

Fabricated from steel pressure tubing, Temtrim can be installed with fins exposed or with one of three attractive covers: snap-on metal grille, flat top cover, sloping top enclosure. Temtrim comes in two tube sizes to meet any heating requirement and convenient lengths of 2 to 12 feet, in one-foot increments.

For more information about Temtrim Finned Tube Radiation for industrial, public and commercial buildings, see your local American-Standard distributor or write to the Plumbing and Heating Division, American Radiator & Standard Sanitary Corporation, P. O. Box 1226, Pittsburgh 30, Pennsylvania.

AMERICAN-Standard

HOT WATER HEAT



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Because the fan on the roof often becomes "the forgotten fan," it frequently breaks down from exposure to wind and weather and from lubrication neglect.

With a weather eye toward this fact, Utility has designed a full series of precision-engineered blowers with permanently sealed, pre-greased ball bearings. They require no further greasing, and can't break down from lubrication neglect.

What's more, motors and drives are completely enclosed—making them forever impervious to dirt, dust, moisture and drastic temperature changes.

Manufacturers of heavy and standard duty blowers for heating, air conditioning and ventilating installations. Producers of blowers and blower parts for original equipment manufacturers. Write for catalogue data.

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ROOM AIR DISTRIBUTION . . .

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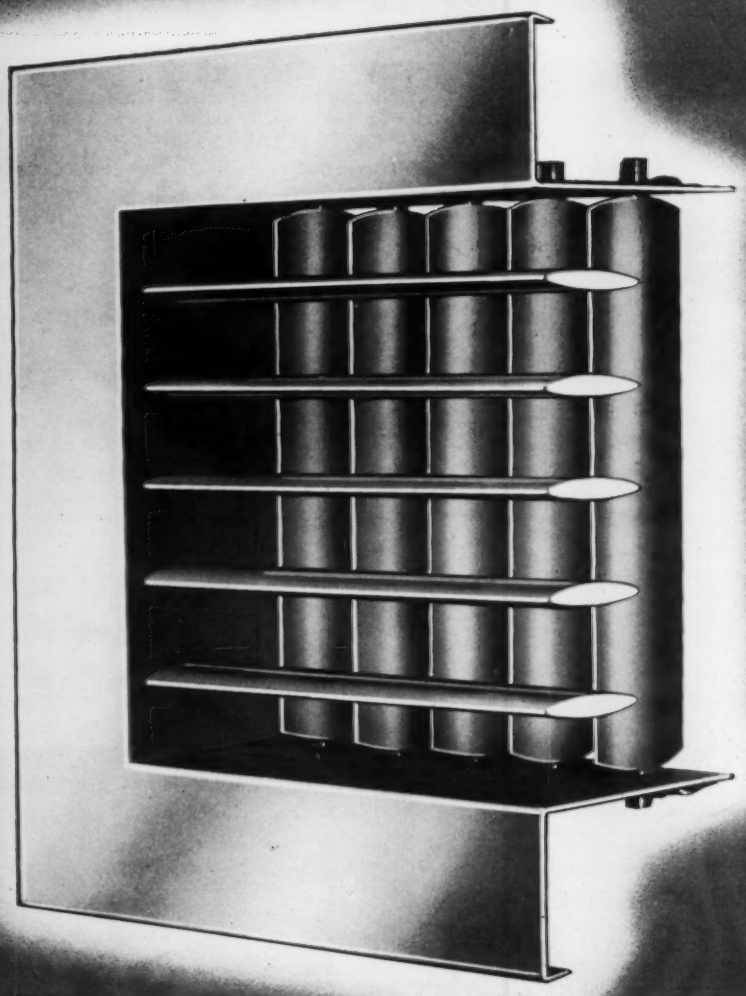

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50% OF GRILLE ENGINEERING & ADJUSTMENT PROBLEMS

NEW MORE AIR CONTROL BUILT-IN

By engineering MORE AIR CONTROL per square inch into each diffuser and grille . . . *right at the factory* . . . Titus simplifies all phases of grille *specification, selection, installation* and *adjustment*. Eliminates any necessity for special factory schooling or instruction at the contracting, engineering or tradesman level. Any workman can install a Titus grille without unbalancing the whole expensive system.

NEW MORE SIMPLE INSTALLATION

Install grille in 2 easy steps. (1) Fasten grille in place with screws. (2) Adjust louvers for correct air patterns. Titus *makes it easy, makes it simple* to obtain correct air patterns . . . patterns that give *maximum room comfort . . . from any air conditioning system.*

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Most important . . . any miscalculations that have crept in during the installation period may be simply and easily corrected by quick adjustment of streamlined Airfoil louvers. ADJUSTING IS DONE *WITHOUT* REMOVING GRILLES FROM WALLS. COSTLY TIME-CONSUMING "CALL BACKS" ARE ELIMINATED.

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All Titus grilles and diffusers are built under the most rigid, precision-controlled standards. They give finest air diffusing performance. Air control cannot be lost at the installation level. Titus grilles are so carefully constructed it is almost impossible to have anything but correct diffusion of air . . . no matter who installs or adjusts them.

SETS PERFORMANCE STANDARD FOR ENTIRE AIR CONDITIONING SYSTEM

Directs air where it is needed. Keeps uniform temperatures throughout room. Eliminates old-fashioned drafts . . . low level stratification. Truly controls comfort . . . *at the room level* . . . THE ONLY AREA WHERE THE UNIT'S ENTIRE HEATING OR COOLING PERFORMANCE IS JUDGED.

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Get information on the complete line of Titus grilles now.
Order actual samples. Look at them. Hold them in your hands. Test them. See for yourself why Titus can save you money. Can give you better air diffusion performance . . . in every type of building where air conditioning is used.

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Gentlemen: I wish to simplify my grille installation problems and to lower my grille installation costs. Please send me complete information on the following Titus grilles.

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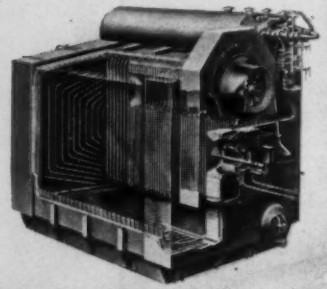
Another Watchdog for 165 Million Americans

Soon to rise out of the sea, this "Texas Tower" will stand on the continental shelf along the Atlantic coast. One of a number of unique radar platforms planned to strengthen national defense in the Air Defense Command's mission of defending the United States against possible enemy air attack, it will be installed in relatively deep water. The platform, housing billets, mess facilities, equipment and storage area will be well above the highest waves expected at the site. Part of the weather deck will be available as a helicopter landing area.

Out in the open sea, an installation of this importance must have steam generators that are completely reliable and efficient. The fact that two oil-fired B&W Boilers, Type FM have been selected to serve this unusual installation, is a tribute to their established reputation for dependable service. Having a 10,000 lb per hr total steam capacity, these units are equipped with electrical controls and safety features, are completely automatic, and require very little supervision. Operated alternately, each FM will individually carry the full steam load for heat, hot water, laundry, and cooking requirements.

In going to sea for this special job, B&W FM Boilers join all the B&W Marine Boilers supplying steam for both commercial and naval vessels. With a record of dependable and economical service to industries, utilities, institutions, and other users, FMs are now serving in virtually every category requiring steam. An indication of their widespread application is their total steam capacity, in service or on order, of more than 11,000,000 lb of steam per hr. More than half of this capacity is in space-saving multiple-unit installations.

Compact, versatile, the shop-assembled FM is available in standard sizes for steam loads ranging between 2900 and 40,000 lb per hr at pressures to 235 psi—is widely used for higher pressures and with moderate superheat. Whether your requirements are unusual or conventional, we'll be pleased to show you how the FM Boiler can help reduce the cost of your steam. The Babcock & Wilcox Company, Boiler Division, 161 East 42nd Street, New York 17, N. Y.



FM BOILER SIMILAR TO THOSE INSTALLED IN THE RADAR PLATFORMS

BABCOCK & WILCOX

BOILER DIVISION

G-713

THE EDITORS' PAGES

• *"ETERNAL VIGILANCE is the price of liberty." While hopes for peace and freedom have risen throughout the world since The Summit, national defense leaders must nevertheless continue to strengthen military establishments to be prepared for any alert. Along with new developments in weapons, new bases must be constructed and others modernized, including mechanical services. The installation of the new $4 million central plant high temperature hot water heating system at McGuire Air Force Base, Wrightstown, N. J., is described in an article in this issue beginning on page 101.*

Construction Awards Set Highest July Record

. . . nonresidential leads in gains

CONTRACT AWARDS for future construction in the 37 states east of the Rockies set a new high record for any July, according to the F. W. Dodge Corp.

The total was $2,271,537,000, up 24 percent from July 1954.

The first seven months set a new high for that period, $14,254,308,000, up 29 percent from 1954. It fell only a shade short of matching the first nine months of last year when the total was $14,477,181,000.

Nonresidential led the way in percentage gains over last year. The July figure was the third highest ever attained. It was $892,629,000, up 39 percent from last year.

For July the residential total was $959,020,000, up 29 percent from July 1954. Public and private works and utilities totaled $419,888,000, down 7 percent.

Seven-month totals were: nonresidential, $5,025,142,000, up 24 percent over the same period last year; residential, $6,415,750,000, up 36 percent; and public and private works and utilities, $2,813,416,000, up 22 percent.

Industrial Ad Policy Adopted by ASRE

. . . to guide industry

A POLICY on industrial advertising as related to ASRE standards was adopted recently by The American Society of Refrigerating Engineers. This policy is stated as follows:

"ASRE Standards are established to assist the members of the refrigeration industry and the public by offering a uniform method of rating and testing refrigeration equipment, by suggesting safe practices in designing and installing such equipment, by providing proper definitions of this equipment and by providing other information which may serve to guide industry. The creation of ASRE Standards is determined by the need for them, and conformance to them is voluntary."

However, says the ASRE, in referring to this standard and in marking equipment and in advertising, no claim shall be made, either stated or implied, that the product has been approved by ASRE. The following form of statement should be used: "A representative product sample of the —— model has been (rated) (tested) in accordance with ASRE Standard #——."

Gas Sales Up 4.8 Percent Over Last Year's Sales

. . . manufactured gas down

SALES of the gas utility and pipe line industry to ultimate consumers in June — latest month for which figures are available — totaled 4,442 million therms, according to the American Gas Association. This is 4.8 percent more than a year ago. The Association's June index of total gas utility sales is 191.5 percent of the 1947-1949 average.

Natural gas sales in June totaled 4,218 million therms, a gain of 5.2 percent. Manufactured and mixed sales decreased 1.6 percent to 223.3 million therms. (Sales of mixed gas rose 1.1 percent to 195.3 million therms, while sales of manufactured gas declined 16.8 percent to 28.0 million therms in June.)

Continued conversions from manufactured to natural and mixed gas distribution accounts for the decline in manufactured gas sales.

Gas Industry Construction At Second Highest Level

. . . forecast for next four years lower

THE GAS UTILITY and pipe line industry spent $1055 million during 1954 on construction of new facilities, the American Gas Association reports. It is expected that in 1955 the industry's total construction expenditures will aggregate $1385 million. This would make 1955 the second highest year, surpassed only by the total of $1462 million in 1951.

Transmission expenditures in 1954 totaled $394 million and are estimated at $725 million in 1955. Two major pipe line projects are expected in 1955. The Pacific Northwest Pipeline Co. is expected to construct a 2000 mile pipe line from the San Juan Basin field in New Mexico to major cities in Idaho, Oregon and Washington. This line will cost an estimated $160 million. The second project is the proposed 1200 mile, 30 in. American Louisiana Pipe Line Co. line from Louisiana to the Detroit area. The cost of this will be about $130 million.

Construction of these lines and other smaller projects brought natural gas pipe line mileage up to approximately 420,000 miles at the end of 1954. Construction of distribution facilities also is on the upturn. And about $441 million will be spent this year to serve new space heating demands.

As for the future, the industry expects new construction costs during the four years 1955-1958 will equal about $4315 million, somewhat under the record $4933 million spent on this work in the 1951-1954 period. The forecast includes totals of $1205 million for construction

in 1956, $974 million in 1957, and $751 million in 1958. It is pointed out by the AGA that these estimates are most conservative since companies tend to underestimate construction expenditures.

Heating Industry Not So Backward as Some Think

. . . says industry leader

SHORTCOMINGS of the heating industry are discussed with tiresome regularity by "the experts," according to Thomas McDonald, executive vice president of the Minneapolis-Honeywell Regulator Co.

"While the industry is backward in some respects," he said at a recent gathering of editors which HPAC was invited to attend, "it is not as bad as some people would have us believe. The significant progress that has been made in the last decade — in engineering improvements, in the development of combination heating and cooling equipment, and in efficiency — did not just happen but are the results of a thoughtful, conscientious industry.

"In fact, I don't think there is anything wrong with the heating industry that better advertising, publicity, and selling will not correct," he said.

"It's a pity," he continued," that we have not made the public more conscious of the fact there is nothing so fundamental to gracious, comfortable, and healthy living as good heating. That there is no other single feature that can be designed into a structure that will do more — more of the time — for its occupants than well-planned temperature."

46% of Air Conditioning Capacity Is 100 Hp Up

. . . . Chicago installations reported

THERE WERE 998 air conditioning installations totalling 17,976 compressor hp made in the city of Chicago during the first six months of this year. The figures do not include room air conditioners, nor do they include installations in single family or two or three unit apartment buildings, for which no permits are required.

An analysis of the figures shows that 33 percent of the total horsepower is accounted for by jobs of 2 to 10 hp, 21 percent by jobs of 11 to 100 hp, and 46 percent by jobs of 100 hp size or over.

While the five-month total this year showed a 13 percent horsepower increase over the comparable period last year, the six-month total is just slightly less than for the first half of 1954. This is because of one large 3000 hp job credited to the '54 figures. The information was obtained from the files of the city's refrigeration inspection department.

In addition to the figures given, there were a number of window air conditioner installations in commercial buildings, including a bank which is expected to have 600 units when the project is completed.

AIR CONDITIONING INSTALLATIONS (not including room air conditioners) in Chicago for the first six months (January-June) of the year. The horsepower figures include the compressor motor only. A single 3000 hp job boosted the 1954 total.

Year	Number of installations, January-June	Compressor horsepower
1952	592	7,325
1953	611	10,164
1954	1002	18,164
1955	998	17,976

Space Travel Confronted with Hot Skin Problem

. . . caused by air friction

SKIN TEMPERATURES exceeding 1000 F for space ships, because of friction from lightning takeoffs in lower, denser air, is expected to be a severe problem, according to Dr. Stephen J. Fraenkel. Dr. Fraenkel, manager of the Propulsion and Structural Research Dept., Armour Research Foundation, points out that present materials, both metallic and nonmetallic, "place some very definite limitations" on permissible temperature rises.

"It is generally expected," he says, "that few existing materials, if any, will retain adequate strength at such high temperatures."

Also, he points out that the interiors of space ships will have to be adequately insulated for the extreme temperatures anticipated.

Energy Sources in U. S. Change Patterns

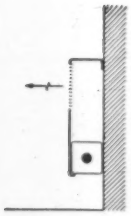
. . . during past 15 years

ENERGY SOURCES in the U. S. have been changing in the proportionate amount supplied by each for the nation's requirements, according to the American Gas Association. Since 1941, natural gas, petroleum, and water power have increased in energy output; however, coal has declined.

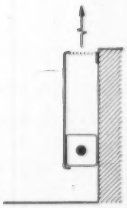
Based on the 1941 index of 100 percent for each source, natural gas produced 309 percent in 1954; petroleum, 186 percent; and water power, 155 percent. Coal produced in 1954 74 percent of the energy it did in 1941.

"Quote"

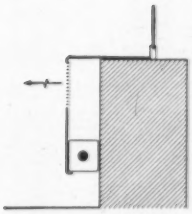
"The nation must reduce waste of intellectual talent as it plans its future industrial expansion."
—Dr. C. Richard Soderberg, dean of engineering, Massachusetts Institute of Technology, at the General Motors Conference for Engineering Educators.



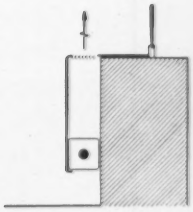
Type CF. Front outlet for wall mounting for 3" or 4" heating elements.



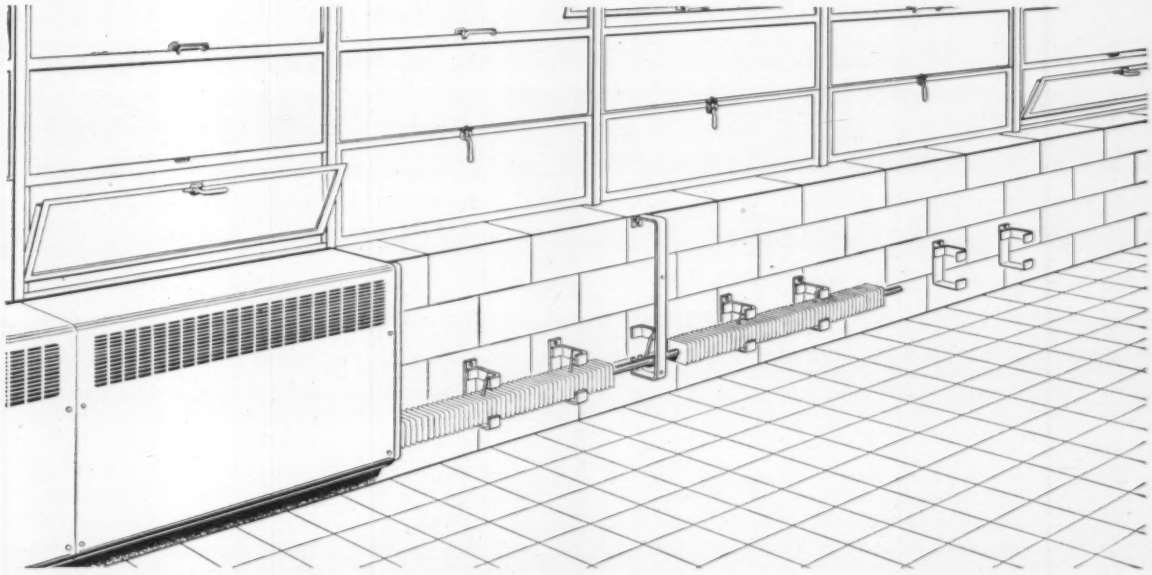
Type CT. Top outlet for wall mounting for 3" or 4" heating elements.



Type CFS. Front outlet integral sill for 3" or 4" heating elements.



Type CTS. Top outlet integral sill for 3" or 4" heating elements.



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Designed into the Building

Custom Webster Walvector, used beneath windows, becomes an integral part of the building . . . in cases it eliminates the need for finished window sills and finishing of walls behind enclosures. Custom Webster Walvector is custom-made to meet modern architectural design and construction requirements . . . is designed into the building construction . . . yet is sufficiently standardized to permit production on an economical basis.

Custom Webster Walvector utilizes the proven principles of Webster Tru-Perimeter heating comfort . . . circles all exposed walls . . . gives clean, gentle, even warmth, without cold spots, hot spots or drafts. But Custom Webster Walvector goes beyond the limitations of standardized production to provide a tailor-made, built-in heating system that effects substantial savings in construction costs.

Enclosures are available in eight basic types, for wall mounting or with integral sill, with either front or top outlet, and for single or double row heating element . . . custom-made to required dimensions, in any increment of length.

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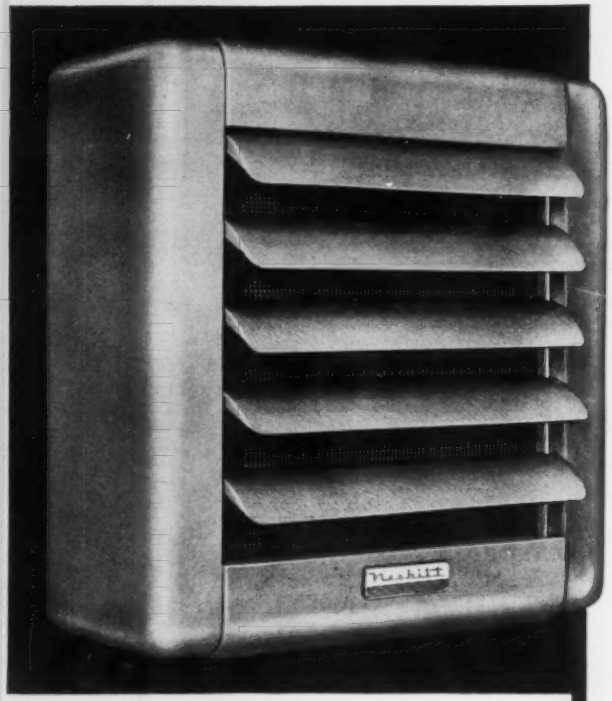

new

propeller-fan unit heaters for steam or hot water . . . without sacrificing capacity

The first unit heaters rated under new Sound Measurement Test Code of IUHA

NESBITTS wholly new propeller-fan unit heaters are the first in the field to be tested by the Sound Measurement Test Code adopted this year by the Industrial Unit Heater Association. All units rated within the four lowest sound classifications! Now you can select models with sound emission accurately classified by type of installation—assuring you the most quiet unit for the capacity required.

That's only part of the story. Nesbitt universal heating elements of flat plate-type fins and U-bend coil construction can be used with either steam or hot water (on high temperature drops) *without sacrificing capacity*. Half as many models meet all your needs. Cuts inventory and selection problems in half! Use of low water rates and high temperature drops permits further labor and material savings on hot water installations.

This new Nesbitt line offers an unusual combination of values in construction, performance, appearance and cost. Send for Publication 401.

plus all these special features:

- Eight basic unit sizes, 24 models ranging from 15,000 to 335,000 Btu per hour.
- Universal heating elements give maximum performance on either steam or hot water systems.
- U-bend coil construction permits high water capacities and temperature drops.
- Low water rates effect time and material savings in piping and installation.
- Minimum air-flow resistance reduces noise level, lowers operating and maintenance costs.
- Seamless copper condensing tubes and bends; corrugated aluminum fins mechanically bonded.
- Male piping connections extending through casing rear simplify installation and save headroom.
- Accurately balanced aluminum fans for quiet, efficient, large-volume air delivery.
- Rugged, heavy gauge die-formed steel casings are smartly styled for modern interiors.
- Deep drawn air intake opening in rear of casing assures maximum fan performance.
- Easily adjustable discharge louvers; available also with double deflection louvers.
- Attractive green metallic hammered finish is baked on phosphatized steel for long life.

Nesbitt

THE NAME TO GO BUY IN UNIT HEATERS

Made by John J. Nesbitt, Inc., Philadelphia 36, Pa.
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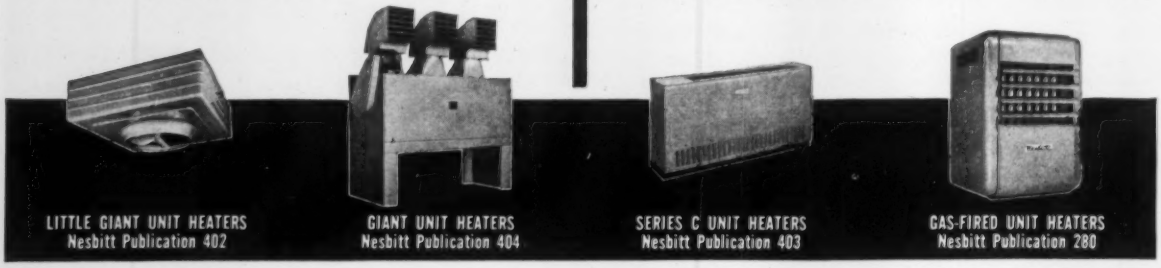


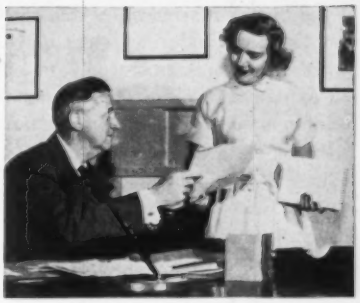
LITTLE GIANT UNIT HEATERS
Nesbitt Publication 402

GIANT UNIT HEATERS
Nesbitt Publication 404

SERIES C UNIT HEATERS
Nesbitt Publication 403

GAS-FIRED UNIT HEATERS
Nesbitt Publication 280

"OPEN FOR DISCUSSION"



• *WE FOLLOW HERE each month the practice at engineering society meetings of providing an "open for discussion" period. You are urged to take part. Just address your comments to the Editors, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.*

Do Workers 'Catch' More Colds from Shifts to Hot and Cold Environments?

I ENJOYED the article, *Air Conditioned Rest Areas Reduce Physiological Stress*, by Dr. L. A. Brouha, in the August HPAC. Several thoughts came to me as I was reading it.

1) What conditions do the men select for their own comfort on leaving a very hot work space? (This question stems from argument as to injury produced by movement from free sweating to non-sweating environment.) I'd like to know if the workers select a temperature so low that they stop sweating. Such data could make another interesting article.

2) Are the shifts into a cool environment, or the returns to a hot environment, harmful in any way; that is, increased incidence of colds, rheumatism, etc.?

3) I am impressed with the author's distinction between acclimatization to hot-dry and to hot-moist environments. I believe this is just recognition of a difference in degree of heat load.

Ford Hick, M. D.
College of Medicine
University of Illinois

Controls Challenge Future Progress In Heating and Air Conditioning

GREAT PROGRESS has been made in the increased variety, scope and reliability of automatic controls during the last 30 years. In both pneumatic and electric types of control we have such devices as: hygrostats and thermostats; high pressure cutouts and low pressure cutouts; automatic water regulators and automatic expansion valves; dry bulb thermometers and wet bulb thermometers; in short, controls responsive to virtually any stimuli we can imagine.

But where do we go from here? Progress only increases the demands and opportunities for more of the same. Here, for example, are a few items we need in heating and air conditioning:

1) A line voltage thermostat good for 1½ hp at 230 volts which turns on either cooling or heating as required, with a neutral zone of approximately 3 F. This control would require no changeover from heating to cooling, or vice versa. My company has had a control like this for many years but, being made up of a three-position thermostat, two relays, a transformer and wiring, it is entirely too costly.

2) A simple inexpensive automatic control that will vary the capacity of the refrigeration compressor in a room air conditioner, so that it balances exactly the widely fluctuating requirements. This will eliminate the uncomfortable rehumidification of the room air which now occurs when a thermostat stops the compressor and the water on the cooling coil re-evaporates.

3) An inexpensive automatic "radiation control" that will maintain a slightly higher mean radiant temperature, when not subject to radiant heat for improving indoor comfort. For example, the west wall of a building receives no radiation in the morning, but a great deal of radiation is received in the late afternoon. Such a control would compensate for this effect.

4) An instrument to automatically sense the "freshness" of the room air which, in turn, would control the minimum amount of outside air that's constantly introduced into a room for maintaining this "freshness." Roughly speaking, it takes three times the equipment and three times the power cost to condition 1 cu ft of outdoor air as to recondition the 1 cu ft of indoor air recirculated to the unit. This is, of course, one reason why the amount of ventilation in an air conditioning system is kept to a minimum.

The luxury of today becomes the necessity of tomorrow only through constant development and progress in allied fields. With automation no longer around the corner but already through the door, none can afford to be complacent. We must all be alert to every challenge for improvement.

Herbert L. Laube
President and Director
Remington Corp.

Objections to Induced Draft Fans Answered by Application, Maintenance

IN COMMENTING on the article, *Forced or Induced Draft?*, in the May HPAC, S. D. Distelhorst says in the July HPAC that the argument against induced draft is "incontrovertible." We believe his strong stand is tempered by the fact that most packaged boilers are

of the Scotch Marine type. One should bear in mind that the Scotch Marine is the only fire tube type of boiler which lends itself readily to pressure firing without extensive redesign of the combustion chamber in order to maintain proper flame patterns.

With regard to fan maintenance, I believe Mr. Distelhorst is thinking in terms of centrifugal fans, whereas there are axial flow fans that use standard motor bearings. It does not have any fan bearings, and so it avoids a good deal of the high temperature problem. Further, since the motor bearings are not in the hot gas stream, there is no entraining of products of combustion, as suggested by Mr. Distelhorst.

Mr. Distelhorst's comments on the control of air volume are well-taken, but a simple damper arrangement will solve the problem of providing proper combustion volume, with either forced or induced draft.

We cannot agree with Mr. Distelhorst on the danger of infiltration to boiler settings, but we certainly see the dangers of exfiltration. If Mr. Distelhorst objects to the pressure downstream from the induced draft fan, the fan could readily be mounted on the roof since the flue must be carried to the roof anyway. Mounted as a flanged section of the stack, the fan would require no special foundations, elbows, or weather housings.

Martin G. Beline
Application Engineer
DeBothezat Fans Div.
American Machine and Metals, Inc.

Need to Promote Acceptance of Heating Economy Factor

EFFICIENCY RATINGS, like batting averages, can either be most illuminating or most misleading. Neither has meaning unless its conditions and limitations are both defined and accepted.

F. W. Hutchinson, in his article, *What We Need Is an Efficiency Rating for Evaluating the Thermal Qualities of Any Building*, in the March HPAC, has proposed the adoption of a heating economy factor. This factor would be an efficiency rating of sorts, which can go a long way toward eliminating what he has aptly termed the "thermal monster" — a structure unbearably hot in summer and either cold in winter or having high heat requirements.

As Professor Hutchinson points out, a simple criterion which the architect, the engineer, and the owner can use in determining the thermal adequacy of any structure is needed. We cannot yet assume, however, that the heating economy factor is this criterion, for the need will not be filled until a specific criterion is quite generally accepted.

The engineer will probably be the first to accept the *HEF* as a step forward. It will give him a starting point from which to promote improved thermal construction without having to lose himself in details. This promotion must be active, however, and it must be participated in by engineers in all phases of the heating and air conditioning and the building industries. Furthermore, it must include the manufacturer of the heating and air conditioning equipment, the distributor or wholesaler, and the heating contractor or installer.

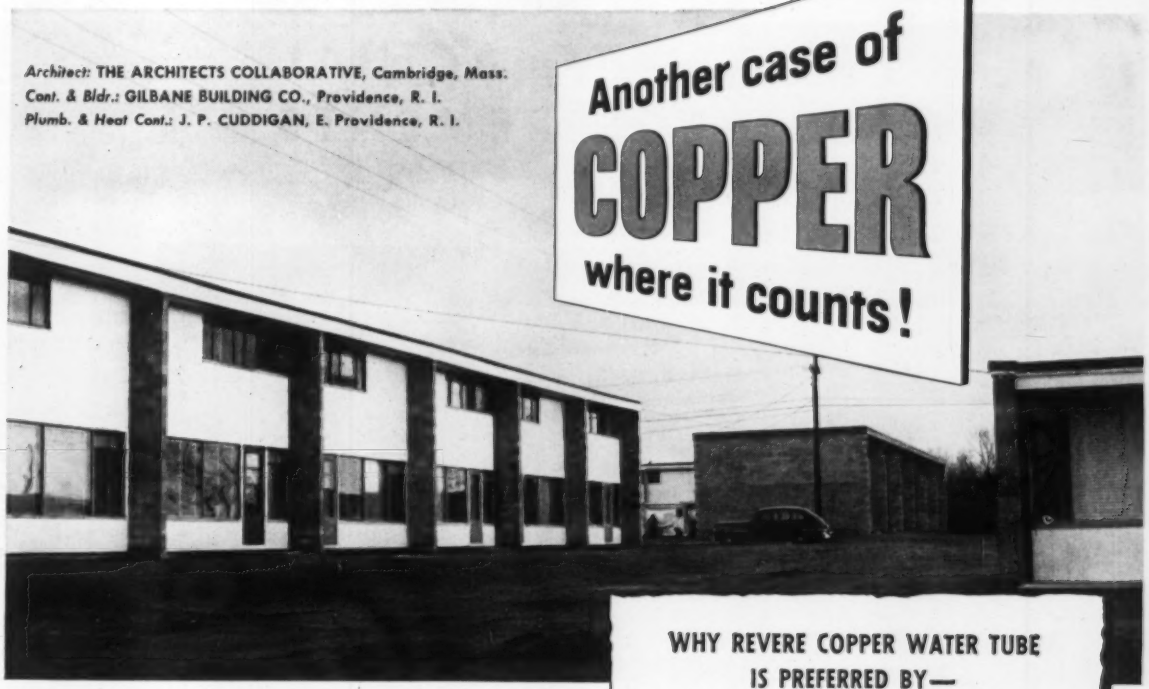
Although it is easy to say that engineers as a group will be willing to accept the heating economy factor and will urge its general adoption, the interest in it will probably vary inversely with the distance between the engineer and the actual installation. Thus, the man nearest the job, the heating contractor or the installer, will probably have less interest in the *HEF* and less knowledge of its potential value than will the engineer who designs the system or builds the equipment. Before the *HEF* can be generally accepted, therefore, a concentrated educational effort must be made in the direction of the installer.

The acceptance of *HEF* by architects will probably vary greatly. The more conservative architects will accept and use the *HEF*, and they will find it a real aid in their work. The less conservative architects will hesitate to use it, since in general they advocate larger window areas, and they may not wish to acknowledge the higher heat loss and lower *HEF* that goes with them. Even though extremely large window areas usually occur in custom designed and custom built structures, it is not at all unusual to have window areas in excess of 25 percent of the gross wall area. Thus, the glass correction factor, G_c, will be important both in the structures of those who are able to support thermal monsters and in those structures which are more conservative. In order to give meaning to *HEF* and G_c, it would seem desirable to base the glass correction factor on a "low average" glass area, such as the 15 percent suggested by Professor Hutchinson.

HEF must be translated from an index number into dollars and cents. Even then, it may be of only limited effectiveness since the building owner generally is not aware of the fuel costs and what may be done to keep them low. The installer might be able to justify the fuel cost by using the *HEF*, but this would be a negative application of what could have been a positive approach at the time the structure was designed.

The foregoing remarks are not intended to minimize the potential value of the heating economy factor. Rather, they are intended to point out some of the difficulties which may be encountered before the *HEF* can achieve its potential. If it is to be of use in upgrading the thermal characteristics of contemporary construction, it will be necessary for an active educational program to be instituted, so that the *HEF* will be both accepted and used by engineers, installers, architects and the public alike. Let us hope that such a program will be undertaken. And let us hope that the concept of the heating economy factor will not be relegated to the status of the good idea that was never used.

Herbert T. Gilkey
Technical Secretary (Research)
National Warm Air Heating
& Air Conditioning Association



Architect: **THE ARCHITECTS COLLABORATIVE, Cambridge, Mass.**
Cont. & Bldr.: **GILBANE BUILDING CO., Providence, R. I.**
Plumb. & Heat Cont.: **J. P. CUDDIGAN, E. Providence, R. I.**

QUONSET POINT HOUSING DEVELOPMENT

(HOSKINS PARK) Davisville, R. I.

200,000 FT. OF REVERE COPPER WATER TUBE USED IN 350 UNITS

This low-cost apartment house project of 64 buildings is new testimony to add to the proof of the economy of using Revere Copper Water Tube for plumbing and heating lines. If you have ever had any doubts as to the relative costs of using copper in your work, this job should dispel them forever.

For on a project such as this, costs are checked and rechecked. And, when, after a close scrutiny of costs, 200,000 ft. of Revere Copper Water Tube was selected for the plumbing and heating lines you can bet your bottom dollar it was because it was the economical material to install.

Further proof of the economy of using enduring Revere Copper Water Tube is shown in the panel at the right. Check these reasons, point for point, and you can readily see why it makes good sense to use Revere Copper Water Tube for radiant panel heating, plumbing and heating lines, underground service lines, processing lines, waste stack and vent lines. See your Revere Distributor for your needs. And if you have technical problems involving the use of Revere Copper Water Tube, one of our Technical Advisors will be glad to help.

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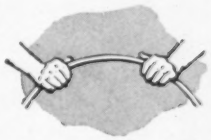
WHY REVERE COPPER WATER TUBE IS PREFERRED BY—

Architects, Builders, Plumbing & Heating Contractors



EASY TO BEND

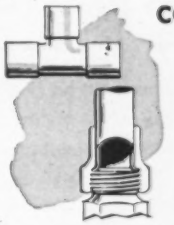
Saves Time

Revere Copper Water Tube is easy to bend. Soft temper can be bent by hand to meet installation conditions.

HANDY LENGTHS

Save Fittings... Labor

Revere Copper Water Tube comes in straight lengths of 20′ in hard and soft tempers. 60′ coils of soft temper reduce the number of fittings needed.



SOLDER OR COMPRESSION FITTINGS

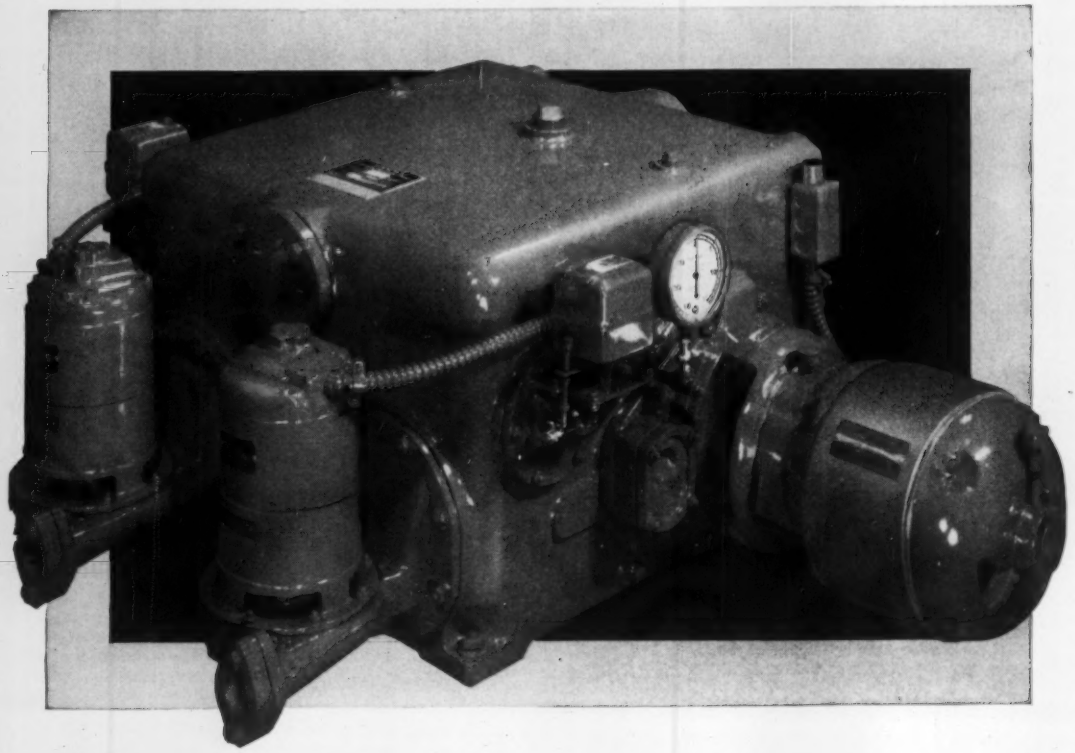
Need Less Work Room ... Save Metal

No worry about wrench room when you use Revere Copper Water Tube with solder fittings. Compression fittings can also be used. No threading is necessary with either type fitting. Wall thickness of tube used can thus be less than for threaded pipe.

NON-RUSTING

Rustable pipe eventually clogs as shown in drawing at top right. Non-rustable Revere Copper Water Tube suffers no loss of flow or pressure as shown at bottom right. No allowance in pipe size need be made for rust accumulation with Revere Copper Water Tube.

THIS NEW VACUUM HEATING PUMP
IS SIZED TO ACTUAL JOB REQUIREMENTS



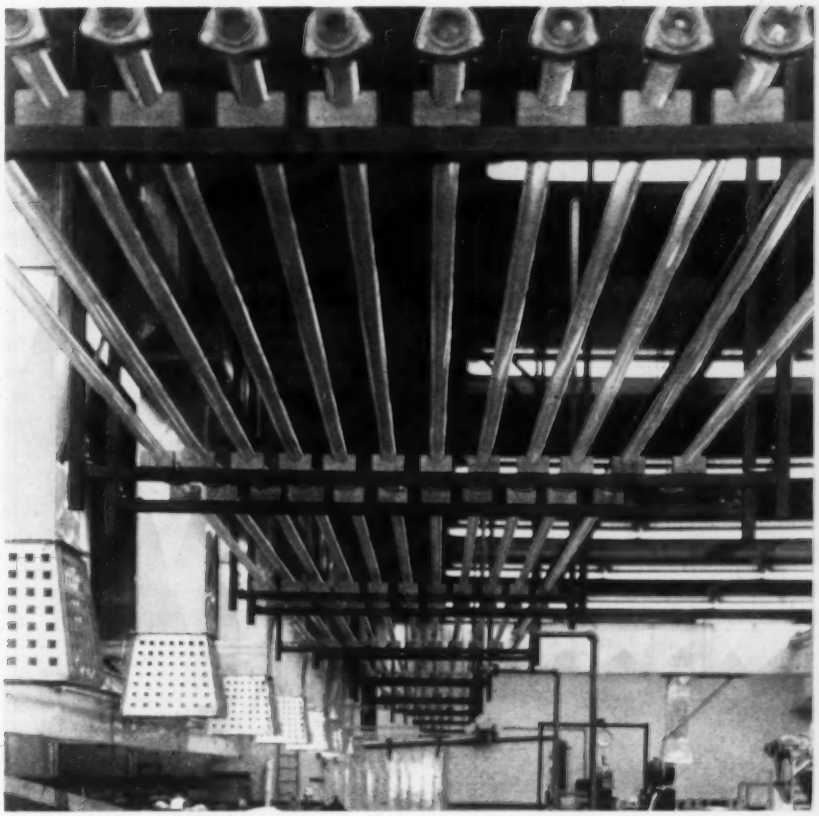
It's the Nash CSM

No longer is it necessary for the Engineer to accept a vacuum heating pump with air and water capacities based inflexibly upon square feet of equivalent direct radiation. With the flexible Nash CSM he can provide for proper air capacity in accordance with his judgment and experience. For the individual capacities of the separate pumps on the CSM may be varied within a wide range, without buying an oversize receiver and oversize water pumps.

These pumps possess many other features which permit a more efficient utilization of fuel and minimum use of electric power. Low, low, returns reduce installation costs and usually eliminate putting the pump in a pit. Simplicity and efficient operation reduce supervision and maintenance costs. Information regarding this new heating pump development is available immediately upon request.

- Increased air capacity induces rapid system response without wasteful overheating.
- Separate air and water pumps individually selected to meet actual job requirements.
- Control system that operates individual pumps only when needed.
- Flexibility permitting addition of radiation without changing basic pump installation.
- Low, low, return line connection.

NASH ENGINEERING COMPANY
438 WILSON, SO. NORWALK, CONN.



HORIZONTALLY SUPPORTED GLASS PIPING, installed 10 ft above the floor, rests on waxed maple cable saddle blocks bolted to metal racks, hung in pairs

Glass Piping Installed to Convey Chemical Dyes

. . . resists corrosion, increases quality control

• 2000 ft of precut 1½ in. diameter glass pipe was installed without breaking a single piece. The main problem was support. Prefabricated racks containing U-shaped pipe supports provide true alignment and slope of the piping. From the central dye-mixing room, nine vertically racked pipes and 14 horizontally racked pipes connect to individual yarn dyeing machines. Although the installation was made by pipefitters who had no previous experience with glass pipe, no difficulties were encountered once the problem of support had been solved.

By M. C. Kendrick

J. E. Sirrine Co., Consulting Engineers

TRANSPARENT, corrosion resistant and heat resistant glass pipe chosen to transport corrosive chemicals and dyes in The American Thread Co.'s textile finishing plant at Sevier, N.C., proved easy to install, reasonable in cost, and economical to maintain.

Glass piping has been in use for a number of years in industrial plants where corrosion, contamination, and

cleanliness are of utmost importance. Good examples are the chemical, petroleum, and dairy industries. However, not until recently has glass piping been used in the textile finishing industry for handling dissolved chemicals and dyestuffs. A few textile plants now have glass piping installations, of which this is the largest.

Manual Handling Expensive

Previous to the installation of glass piping, chemicals and powdered dyestuffs were stored and prepared on the same floor and adjacent to the dye machines, a common practice in textile finishing plants. When possible, the dry chemicals were carried direct to each machine to be used when needed in the dye or bleach cycle.

However, the dyestuffs were dissolved or pasted in stainless steel buckets or containers and transported to the dye machines. This type of handling had many faults. Powdered dyestuffs, when not handled in a closed room, got into the air and settled on the finished yarns, producing specks, and thereby ruining the yarn. Also, when the dissolved dyestuffs were transported to the dye machine, splashing and spilling ruined a quantity of yarn, which at best had to be re-dyed, not to be a complete loss.

Pipe Dyes to Each Machine

When The American Thread Co. decided to move its finishing operation to Sevier, this problem of handling dyestuffs and chemicals was marked for elimination. To do this, a central dye mix or drug room was constructed somewhat above the operating floor, completely closed off and ventilated to prevent any dry powdered dyestuff from getting into the dye house proper. This room was placed in the center of the dye house for accessibility. As planned, the dyestuffs would be dissolved and piped to each machine, thereby eliminating any chance of ruining finished yarns. This method would also give better quality control as the operators in the drug room controlled the type and quantity of dyestuff and chemicals required for each dye batch.

Dissolved dyestuffs are highly corrosive. To resist corrosion and to enable the operator to see what was in the pipe lines, to see when the lines were emptied, and whether they were clean prior to their use again, 1½ in. diameter glass pipe was chosen. In use since 1952, this piping shows no discoloration or corrosion. And it can be cleaned thoroughly by simply flushing water through it.

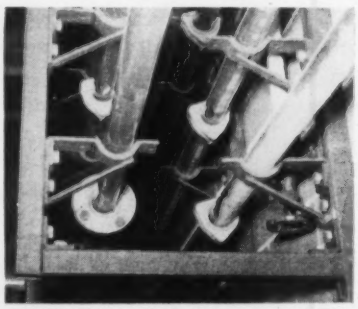
Pipe Ordered Precut

For this installation, field fabrication was not attempted, because of the inexperience of the men who were to install the pipe. The piping layouts were carefully engineered, and all pipe was ordered precut. Of the 2000 ft installed, only one short piece was misfigured and would not fit.

The most important single problem in a glass pipe installation is hanging or supporting the pipe. Glass pipe cannot be supported in a rigid metal hanger, as the movement of the pipe caused by expansion and contraction will scratch it. The resulting thermal shock may cause the pipe to break. Also, this type of pipe cannot be rigidly anchored between two points with no allowance for expansion, since this will also cause the pipe to break.

This installation presented a further problem since the piping had to be supported differently on either side of the drug room. One side was to have nine pipes racked vertically in two layers against a tile wall. On the other side, 14 pipes in a horizontal rack were to be supported from the building steel, about the center of the bay.

Since the vertically racked piping to be installed against a glazed tile wall would attract a great deal of attention, we were requested to install this pipe so that it would have a pleasing appearance without increasing the installation cost. To accomplish this, prefabricated hangers were used. These not only gave the installation a finished appearance, but also saved time in the fabrication of the hanger supports.



SUSPENSION of double row vertically racked piping is shown in detail here

All hangers were fabricated prior to installation with the U-shaped pipe supports loosely bolted so that they could be moved to align the pipe. To prevent the pipe from coming in contact with the supports, ⅛ in. rubber gasket material was cut in strips and glued inside these pipe supports.

The racks were then placed in position on the wall by using toggle bolts and a ¼ in. rod attached to the building steel. These racks, placed in pairs about 2 ft apart, were so spaced that the flanged joints of the pipe are between these supports. Although this method of support is not absolutely necessary, it facilitates the installation of the pipe and in case of breakage would minimize damage to the connecting pipe.

Joined With Stainless Steel

The actual installation was begun in the drug room with a short piece of stainless steel pipe, which extended 6 in. through a wall sleeve and ended with a flange. This short piece of stainless steel pipe was used as a rigid connection in the drug room, where the possibility of breakage was great. To the flange was bolted the first glass pipe fitting, using a special adaptor flange.

After the initial connection, the remaining glass pipe and fittings, with flanges attached, for each run were then placed in the prefabricated racks. The U-shaped pipe supports were then adjusted so that the ends of each piece of pipe made contact over its entire surface with the preceding piece. This procedure assured a true alignment and slope of the piping for its entire length.

After lining up the pipe in this manner, ⅛ in. neoprene gaskets were inserted at each joint between the

ends of the pipe, and then the flange bolts were tightened to a snug fit only. The connection to each dye machine was then made with stainless steel pipe for rigidity, since a valve and a swing joint were to be installed, so that the dissolved dye could be placed in the machine or the piping flushed to a drain.

After each run was completed, the pipe was hydrostatically tested.

The flange bolts do not have to be pulled up as tight as for steel pipe. However, there is no chance of crushing the glass pipe by excess pressure since the flanges and bolts are aluminum and will break or strip before this point is reached.

Use Saddle Blocks for Support

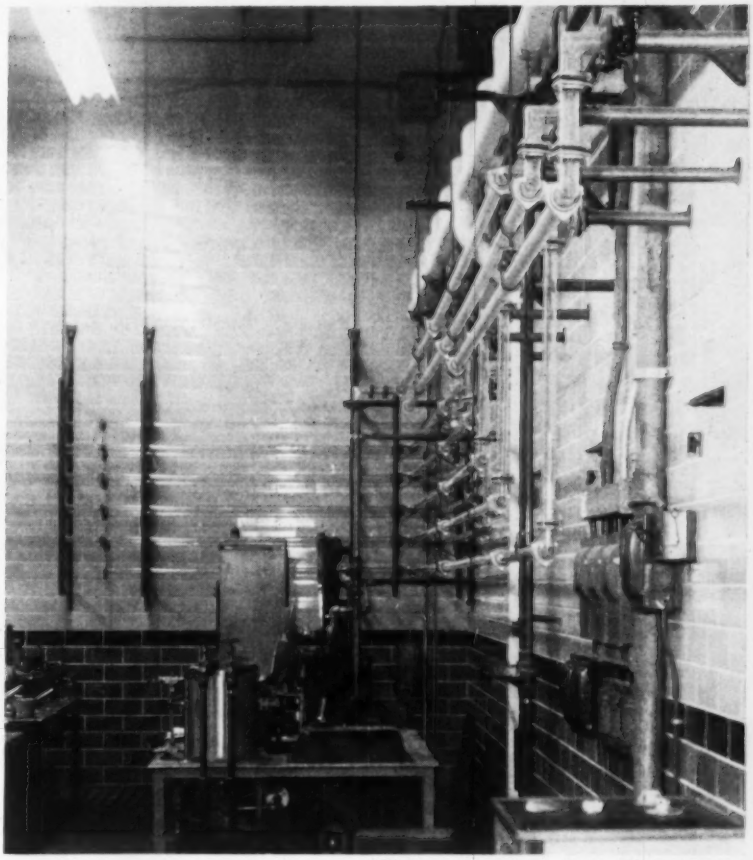
The horizontally supported pipe was installed along much the same lines, except the supports, which presented a different problem. This piping was to be installed approximately 10 ft above the floor and in the center of the building bay. These supports were also hung in pairs from the building roof steel, in order not to present any obstruction on the operating floor.

The main problem was to find a method of support that would avoid contact with the metal rack and would maintain alignment of the piping. To accomplish this, waxed maple cable saddle blocks were selected. These half blocks were bored to the outside diameter of the pipe and bolted to the supporting rack. The glass piping was then placed in these saddle blocks, and the installation proceeded without further difficulty. The use of cable saddle blocks, unique to this installation, proved satisfactory and economical.

More glass piping has just recently been installed to service new dye and bleach equipment. This additional piping, approximately equal to the amount originally installed, was installed in the same way.

Breakage Is No Problem

Some of the more frequently asked questions about this installation concern breakage and the costs of material, installation, and maintenance.



[Photographs courtesy Corning Glass Works.]

VERTICALLY RACKED GLASS PIPING is supported in prefabricated racks. Movable U-shaped supports are separated from piping by rubber cushions. Flange joints are between supports

Breakage need not be of grave concern to anyone contemplating the use of glass piping. With a small amount of extra care and precaution in handling, there should be no breakage whatsoever. This entire installation was made by pipefitters who had never seen nor installed this type of piping before and who, after being instructed on how it should be handled and installed, did not break a single piece of pipe or a fitting. Since its installation in 1952, only one section has been broken and replaced.

Although figures on installation cost are not available at this time, it is a fact that the installation cost of this piping is no greater than that of similar sizes of metal pipe. Although the cost of supporting and hanging for this installation was somewhat higher than for metal pipe — and although extra care in handling was necessary — these would be offset by the cost of cutting, threading, and making joints on metal pipe.

The actual cost of a glass piping system varies greatly, according to the number of fittings required. When purchased in quantity, as for this installation, straight glass pipe costs about one-third as much as other suitable pipe. However, the glass fittings, including flanges and gaskets, cost about three times as much as screwed metal fittings of the same size. Because of the large amount of straight run pipe in this installation, the overall cost was lower than if other acceptable pipe were used.

There has been practically no maintenance required since this system was installed and placed in service in 1952. According to the plant engineer, the only maintenance required to date has been the replacement of a single section of pipe which was accidentally broken.

Apprentice Contests Reveal Skills

THAT ALL MEN are not created equal in opportunities and abilities is a fact. This was never more evident to me than last month, when I served again as a judge for the second annual International Apprentice Contest at Purdue university, sponsored by the United Association of Journeymen and Apprentices of the Plumbing and Pipe Fitting Industry of the United States and Canada.

The international contest is the climax for winners of state and regional competitions. Varying degrees of judgment, skill, knowledge, and practical experience were evident in the way the apprentices came prepared for the contest and the way they tackled the projects.

One crucial test of five year apprentices, besides written examinations, is to form a three-piece elbow from a 3 ft section of 6 in. extra heavy steel pipe. The apprentice must cut the three pieces with an acetylene torch at the proper angles, taper the cut edges with the torch and then weld the joints. He may weld by electric arc or by gas torch. After the weld is made, he must cut three sample coupons across the weld. The approaches were interesting.

The three-joint elbow job is a hot and strenuous one. The man must wear goggles, a helmet, and asbestos gloves. The best three or four of the 36 contestants that I watched finished in four hours, but many were only half done by the end of the four hour limit. Some of them had adequate tools and indicated skill in applying them, while others evidently had served unfriendly or uncooperative journeymen.

One contestant who had served a real mechanic arrived with triplicate pieces of little channel steel, upon which he could support and manipulate the heavy pieces of pipe. He had a little homemade gage to assure that the correct angular cut would be made. His torch quickly was adjusted for proper cutting. He marked off angles for the cuts and identified them by punch marks with tools from his kit. His gloves and his work clothes were clean. His kit even included a package of bandages to use in case of burns.

Another contestant laboriously marked off the angles for the cuts with micrometer accuracy. Then he borrowed a dull punch and followed the marks with dents hammered into the steel separated only by half inch intervals. He made an improper adjustment of the torch and after trying to follow the punch marks, spent at least a half hour before he was able to complete the first cut. The man who can burn an angular hole around a thick steel pipe, following perfectly the exact line, must be a true artist, especially if he cannot adjust his torch.

The first youth assembled the elbow on an assuredly level base, but the second one attempted the assembly on an uneven concrete floor with only chance chisels, hammers, and bricks to steady the three unstable pieces of pipe.

The first youth chamfered or tapered the edges of the pipe preliminary to welding, with segments blocked up so as to permit a downward cut, with oportunity for a hand rest. The second youth, however, tried to taper the edge with the pipe segment in a horizontal position, lying on the floor and with only his thickly gloved hands and his hood-obscured eyes to maintain the ultimate uniform groove at the junction.

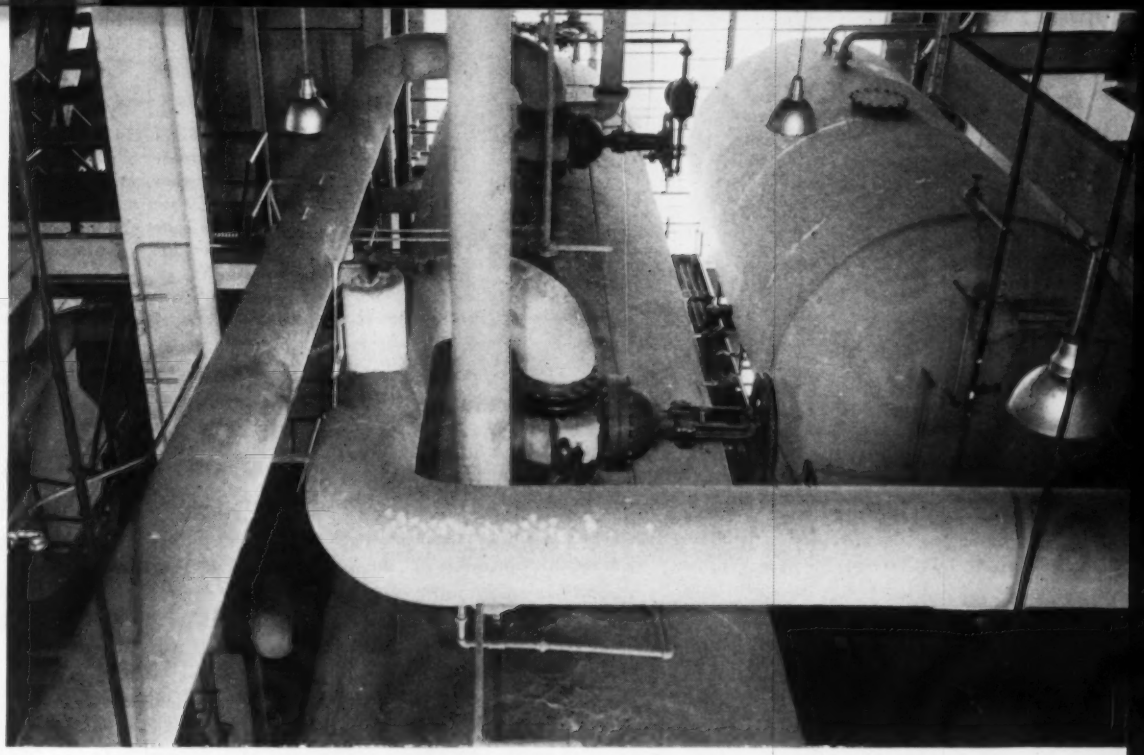
Contestant No. 1, using an electric welder, filled the bottom of the groove, and thus brushed the surface of the new metal to remove slag before building up the next layer of weld metal. Contestant No. 2, however, produced a joint with many holes due to slag imbedded in the presumably homogenous metal.

The coupons cut at right angles across the welds by Contestant No. 1 showed that the new metal filled the groove from the bottom up, without any objectionable surplus projecting outside the perimeter and without any icicles inside the pipe. The coupons from the work of Contestant No. 2, however, indicated that he had overcut, so that the thickness of the pipe at the edges of the new weld metal, was reduced.

I had no meter to measure the electrical enegry consumed in making the elbow by Contestant No. 1 or to measure the costly oxygen and acetylene that he consumed, but in my opinion, the first apprentice completed his task with less than half the fuel cost required by the second apprentice. Contestant No. 1 was through in 3½ hours.

As last year, I was impressed by the fine looks and budding skills of the 1955 crop of five year apprentices. Several of the contractors present — many members of the Mechanical (heating, piping & air conditioning) Contractors Association of America attended the conference — were also impressed. I heard several testimonials from them as to the efficiency, skill, and other fine qualities of the apprentices who participated in the first contest last year.

SAMUEL R. LEWIS, consulting mechanical engineer and a member of HPAC's board of consulting and contributing editors, comments informally each month on practical heating, piping and air conditioning problems.



TWO 30 TON EXPANSION TANKS, each holding about 15,000 gal of reserve high temperature hot water, are connected in parallel by the immense mains in the foreground. Terminal points for the heating medium, the tanks have an operating pressure of 300 psig. The smaller tank contains 10,600 gal of chemically treated make-up water and is bled when replenishment is needed or when cold water is desired to reduce the temperature of the boiler discharge

$4 Million HTHW System Heats McGuire Air Force Base

By Alexander Sage

Vice President & Chief Engineer
Charles Simkin & Sons, Inc.
Engineering Contractors

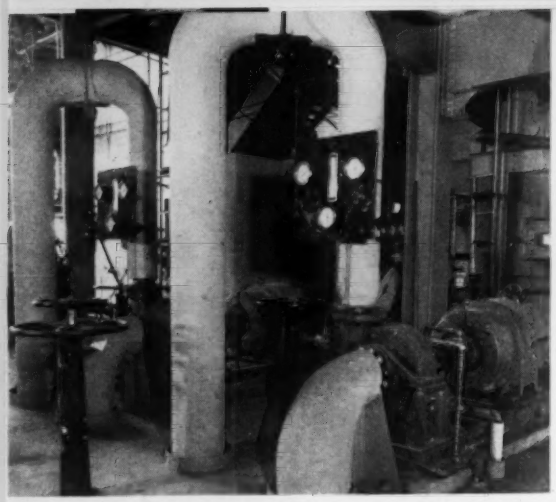
• Four stoker fired, forced circulation high temperature hot water boilers, each with 50 million Btu per hr capacity, heat water to 420 F for heating barracks, hangars, warehouses, and service buildings. Each boiler is self-contained and can individually supply the two independent distribution zones. Flow and return pipe lines and compressed air lines extend for 33 miles underground.

HIGH TEMPERATURE HOT WATER has been selected by the United States Air Force for McGuire Air Force Base, Wrightstown, N. J. The Air Force's preference is the result of extensive studies to determine the most economical method of heating air bases, the largest single item of base operation expense.

Advantages of the medium are low initial cost, low fuel cost, and low operating and maintenance costs, all of which have been substantiated by actual operation data.

The inherent advantages of HTHW heating stem from two basic facts: (1) It is a completely closed system; and (2) High rates of heat transmission can be obtained. Small pipe sizes with correspondingly low unit costs make HTHW especially attractive for large systems.

Heat carrying capacities of pipe lines are more clearly understood when one considers that 1 gpm will deliver approximately 100,000 Btu per hr for a 200 F temperature drop. For example, in one 1000 ft by 200 ft warehouse on the base, HTHW is used directly in downblast unit



TWO SETS OF ZONE CIRCULATING PUMPS deliver a 125 hp push each to a stream of high temperature hot water. Each pump set serves about one-half of the 11½ mile distribution network. Water leaving at 420 F drops about 80 F at the point of consumption and regains this heat loss on its return through the heating circuit. Handwheels at left control valves in the basement for blending somewhat cooler return water with outgoing water to lower the initial temperatures to the desired margins

heaters. No heating pipe is larger than 2 in., and circulation is maintained by the district pump in the central heating plant.

Another advantage is that HTHW plants do not have to be sized for peak demands. Water can retain its heat for relatively long periods and large volumes of water are stored in the expansion tanks. The efficiency of the system is kept comparatively high by using relatively small pipe sizes. The velocity of the water throughout the distribution system is sometimes as high as 12 fps. The temperature drop in the distribution is only one-half of 1 percent.

The capacity of the system at McGuire Air Force Base is about 200 million Btu per hr, although its present load is only about 62 million Btu per hr.

The McGuire installation is designed to serve 75 buildings under construction and others to be constructed from a central heating plant. Barracks, dormitories, mess halls, utility rooms, and miscellaneous buildings widely dispersed are linked by 33 miles of heavily insulated underground piping.

The high temperature hot water is used directly in heating hangars, warehouses, and service buildings. However, in most of the buildings the high temperature hot water is brought to a utility room, where the required low temperature water is generated in heat exchangers, or steam of the required pressure is generated in steam producers. Steam producers and heat exchangers are equipped with closed circuit high temperature hot water coils.

The distribution system consists of a flow and return line in underground conduit, with all buildings connected thereto in parallel. The mains, in general, follow the contours of the ground approximately 4 ft below grade. Vents are located at high points, drains at low points. Manholes or valve boxes are provided for future expansion.

Maximum economy of operation is achieved by keeping flow and return temperatures down to minimize losses. For this reason, the distribution piping was designed for three zones, to permit utilization of the lowest flow water temperature in each zone compatible with the characteristics of steam producers served.

The distribution piping is served by four system circulation pumps, two of which are in operation while two are spares. Space is provided for additional pumps. On a normal winter day, approximately 2500 gpm are circulated through the system to satisfy building consumption and bypass requirements.

• air force base HTHW system

THE TECHNIQUE of pumping high temperature hot water under great pressure to distant consumer points is not new, developing as it did from experimental efforts in the early 1920's to circulate water at high temperature and pressure through a closed system. But the mechanics of this method are new. The design of a boiler house with the capacity to convert up to four tons of coal to 50 million Btu per hr, quickly and cleanly, a recent feat, is a reality at McGuire's new installation.

Ground was broken just 13 months before completion. Nearly 10,000 lineal feet of concrete piles were driven to support the 115 tons of structural steel framing for the 72 ft high boiler house. A 60,000 sq ft partially enclosed platform of 8 in. thick high stress concrete was poured for coal storage.

While the boiler house was under construction, and deep trenches were dug for underground distribution lines, every section of conduit, pipe and ductwork, every foundation and assembly, every fabrication and installation detail was worked out on paper and carefully time-scheduled. Infinite pains were taken to anticipate and resolve fabricating problems on the drawing board.

Time savers that considerably reduced the duration of boiler house construction included:

1) Prefabricating all piping 3 in. and over.

2) Designing and dimensioning rollers and spring hangers at the contractor's office to eliminate cutting

The design of the system is based primarily upon field data experience gained in the process of designing, installing and operating high temperature hot water heating systems over a period of 25 years.

High temperature hot water is generated at McGuire with a maximum pressure of 280 psig and 415 F. Mixing water at the system circulating pumps can reduce the flow water temperature to 350 to 400 F, depending on zone requirements. After line losses — through radiation in transmission and return — a final minimum temperature of 340 to 390 F exists at the most remote point of the system.

The temperature drop between flow and return in the system can vary from a minimum of 125 F to a maximum of 215 F. The design temperature drop is balanced against the line sizes in order to strike the most economical compromise between first cost and operating costs. Pipe lines were sized with a friction head loss ranging from 3 to 20 ft per 1000 ft.

Four boilers, each of 50 million Btu per hr, were initially installed. These boilers are of the controlled forced circulation, radiant tubular type, stoker fired, complete with boiler circulation pumps, combustion controls, forced and induced draft fans, dust collectors, and ash handling equipment.

Each boiler section is self-contained and can individually supply McGuire's two independent high temperature hot water distribution zones, feeding 420 F water under high pressure into 10 and 12 conduits, which branch arterially into a network of pipes reaching 75 equipment rooms. There are three lines to the circuit — two equidiameter outgoing and return high temperature hot water lines.

A 3 in. tube supplies compressed air, produced at the boiler house, to air receiver tanks in the equipment rooms for the operation of air actuated controls, including a series of pneumatic pressure regulators, which activate the domestic heat convertors, the hot water generators, and steam generators.

Domestic hot water leaves at about 160 F and the low pressure steam is used for kitchen facilities and other installations. Although the majority of the 75 buildings in the network extract their heat through a transfer station, several special purpose housing units utilize the high temperature water directly through a system of air heaters.

Two expansion tanks accommodate the expansion of water content of the system. They also serve as a heat storage reservoir of the system during low load periods by accumulating heat delivered to them by the boiler circulation pumps. The 420 F water stored in the tanks — 30,000 gal — is maintained at a nearly constant 300 psig.

The height of the steam-water line in the drums is adjusted by float level controllers, which operate make-up feed pumps and feedwater heater solenoid valves. On provocation, the controllers set off visual and audible alarms in the main panel control board on ground floor level.

The pneumatic valves control the flow of high temperature hot water, so that the proper amount of cold water will mix and prevent the discharge from being hazardous.

The valves, with overflow provisions, are integrally linked to mixing controls which admit measured quantities of cool water into the tanks to lower saturation levels and prevent flashing. Boiler make-up is tapped from a 10 ft diameter by 18 ft tank. City water is used. Passage through a conditioner and additional chemical treatment prepares the water for emergency make-up before storage in the 10,600 gal cold water tank and subsequent migration through a 25,000 lb per hr feedwater heater. Thermal energy is admitted from the water to bring the make-up to 210 F from an average 50 F input temperature. This water discharges into the system together with the heat-exhausted liquid returning to the boilers.

Automatic softener equipment consists of two cylinders with automatic multi-way valves and a built-in regeneration brine ejector. It has a softening capacity of 200 kg of calcium carbonate per cycle and maintains a flow capacity of 18 gpm.

installed in record time

them at the installation point.

3) Scheduling rigging and erection so that each operation proceeded simultaneously but without interference or interruption.

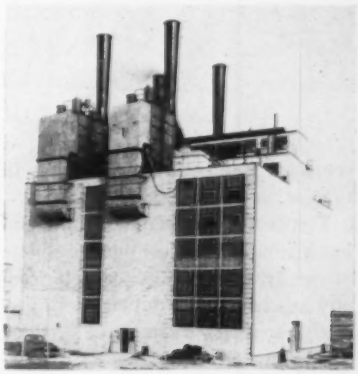
4) Preparing sleeve drawings, insert drawings, and foundation bolt drawings even before the footings were completed.

During the record-time installation, the four boilers were assembled at the site.

Each boiler has an independent forced and overfire draft system, which is energized by four 18,300 cfm forced draft fans in the boiler house's deep basement.

Filling the greater portion of the operating floor are the boiler fireboxes, automatic spreader stokers, and four forced draft cooled traveling chain grates.

The design provided for six 40 hp electrically driven pumps to circulate water at 1200 gpm to two 8 ft diameter by 40 ft expansion tanks. Each 28 ton tank is mounted on a fixed support at center and on



THE NEW BOILER HOUSE towers over the squat hangers and sweeping runways of the air base

BENDS, LOOPS, MANHOLES, AND ZIGS in the distribution piping posed ticklish problems. Dynamic responses of conduits to thermal extremes were provided for by cold-stretching loops prior to welding and by insulating curved lengths with a "lean" concrete-vermiculite mix. Hydrostatic testing inflicted 500 psig on water lines before they were approved

rollers at each end to accommodate expansion.

The expansion tanks are an integral part of the boiler system. The four boilers are constructed without upper tanks, but they are tied together with the two expansion tanks, so that the entire system makes one large boiler system. The upper part of each tank serves as a steam cushion to maintain a constant pressure on the system. The tanks are tied together as a unit by balance lines for the water at the bottom and for the steam at the top. The tanks are designed for 400 psig pressure at 420 F.

Advanced assembly line methods were used in the installation of 165,000 lineal feet of underground pipes. After excavation of 11½ miles of trench to predetermined depth and slope and the laying of a continuous 4 in. reinforced concrete base along its floor, trucks hauled in lengths of pipe. As soon as the concrete hardened, cranes lifted and set pipes on small concrete blocks spaced along the base.

Welders moved in shifts along the pipelines, joining sections. They were dispatched to more time-consuming operations on expansion bends and manholes whenever they overtook the pouring or pipe laying teams.

Pipes varying from 12 in. to 3 in. were heavily insulated in a concrete-waterproofed vermiculite envelope and hydrostatically tested at 500 psig.

A corrugated paper sheet was wrapped around the lines, and forms were spaced around the pipe to provide a 2 ft by 4 ft square channel for containing a special, poured concrete envelope until it set. The forms were lined with two plies of tarred paper and three intermittent coats of tar, and a vermiculite concrete mix.

A final coating of a waterproofing membrane protects the concrete envelope. An additional 4 in. thick slab of concrete on three sides of the curved sections and an envelope wall 8 in. thick at the roadway and rail crossings completed the distribution network.

• system has high capacity

COAL was chosen as the fuel because of the relative economy of operation, and the availability in time of an emergency.

The coal is delivered by rail and truck from a rich, contiguous source of supply. Modern high capacity coal and ash handling equipment are precisely engineered into the system. They function synchronously and instantly respond to automatic control or manual adjustments, depending upon fuel feed and circulation rates.

Graded coal can be stored or can be immediately shunted through an underground conveyor tunnel to a coal crusher, which reduces oversized pieces to 1¼ in. The coal is delivered by elevator to a horizontal over-bunker drag conveyor, which evenly distributes its load into a 360 ton capacity storage bunker.

The capacity of the coal handling equipment is about 60 tons per hr. It moves through seven different change chutes into a hopper above the boiler room. These chutes are opened and closed so as to retain a relatively constant level of coal in the hopper.

Should coal ever reach the capacity line of the hopper, an end switch automatically shuts off the flight conveyor. Metal chunks in the coal are removed by magnetic separators. Coal is weighed automatically and feeding to the stokers is controlled by a metering device.

The primary stage of ash pickup

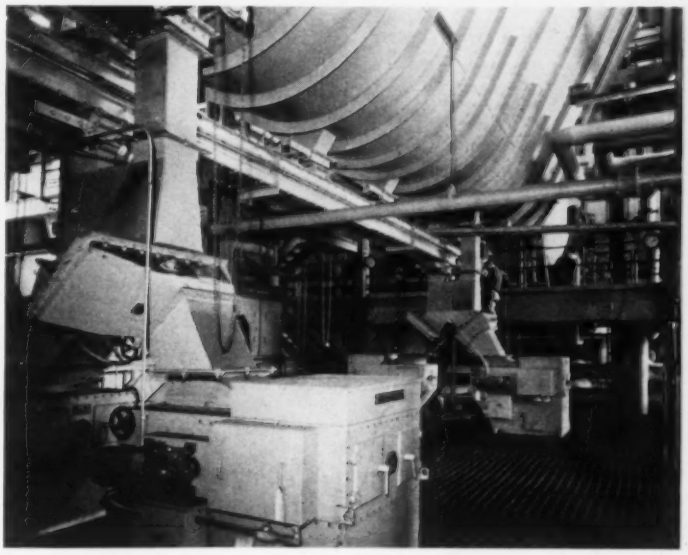
• scales ration coal to stokers

CRUSHED COAL is dropped from a 360 ton overhead storage bunker through discharge gates to a horizontal conveyor above the scales. From the conveyor, coal drops into two intermediate storage hoppers that feed equal quantities of material to the four scales through twin discharge chutes at the base of each hopper. Coal may also be fed directly to the hoppers from the bunker.

Coal falls from the intermediate storage hopper onto a belt feeder inside the scale and is delivered to the weigh hopper. Suspended from a weigh beam, the counterbalanced weigh hopper receives coal from the belt feeder until the beam reaches a balance. This stops the belt automatically.

Coal is discharged from the weigh hopper through a downspout to a stoker on the floor below. Then the door closes, and feeding and weighing cycles are automatically repeated.

If the stoker is not ready to receive coal immediately, the product collects in the downspout. When the column of coal reaches the height of the hopper door, it holds the door open. Since the belt feeder only operates when this door is closed, additional coal is prevented from being fed into the system.



FOUR COAL SCALES, each with a capacity of 200 lb, provide stokers with a total of up to 60 tons of fuel an hour

Each scale services an independent boiler firebox. Any interruption in the feed, or any irregularity in the weighing cycle registers on a remote control panel. [*Photo courtesy Richardson Scale Co.*]

coal and ash handling equipment

is in the subbasement. Hot clinkers drop from the traveling grate into a pit, from which the ashes are propelled pneumatically, via abrasion resistant piping, to an outside silo. Fly ash is removed from blue gases as they rise through four mechanical dust collectors operating at separation efficiencies above 90 percent. Electrostatic precipitation constitutes final purification of the effluent gases before they are cast off through stacks at a high rate of 28,000 cfm.

The air stream conveying the heavier ash through the pneumatic ash handling system deposits its wastes in a secondary ash separator and passes through a steam exhauster and air washer, where it is cleaned. Steam used in the washing stage is condensed and drained off into a disposal line to block the escape of a water spray into the atmosphere.

A sensitive electric eye 'haze gage' helps eliminate soot-laden stack discharge. The gage registers smoke density in the base of the stack and actuates the controls for air and coal feed, draft zones, and operating differentials to readjust the system for the most efficient smoke-free combustion.

Ample storage for ashes is provided by a 118 ton capacity silo, which is equipped with primary and secondary dust collectors, and a rotary dustless unloader with a star gate. Ashes are dumped into trucks for disposal periodically.

• control panel records and controls HTHW system

THE CONTROL PANEL is the nerve center of the complex system. Facilities are provided for recording on one instrument board every condition at any point, at any moment — and controlling as well as recording, all significant data.

A deficiency at any one stage of fuel movement, generation, circulation, or waste removal will start the appropriate alarm, one of 30 separate warning signals installed in the board. Discrepancies from set values will be automatically compensated and will be recorded.

Complete manual control, also, of the far-flung processes can be easily exercised from the control panel.

On the instrument and control panel, the expansion tanks have four level control points with switching devices. At the highest point the overflow system is actuated and an alarm is sounded. The bottom and top points occur only in emergency conditions, and the normal operating level is between the second and third point. The level in the feedwater heater is maintained in conjunction with the levels of the expansion tanks.

There are two combined combustion and instrument panels, upon which are mounted the following devices:

• Master Controller, to keep expansion tank pressure constant.

For each boiler:

• Six draft point gages—
  1) Forced draft duct.
  2) Undergrate pressure.
  3) Overfire pressure.
  4) Firebox draft uptake.
  5) Draft at the mechanical dust collectors.
  6) Draft at the electrostatic precipitators.

• Combustion meters, which record the CO_2 content and flue gas temperatures.

• Temperature recorder.

• Smoke density indicators, one in the uptake from each boiler. A light source on one side of the duct reacts upon the photoelectric cell on the opposite end in variance with the amount of smoke between. This impulse is transmitted and amplified by means of vacuum tubes to indicate the ratio of smoke.

• Fuel air ratio controls with the dampers and motors.

• Differential draft pressure control, which is connected to the inlet and outlet sides and arranged to actuate relays to break the circuits of the forced draft fans and stoker motors.

• Air flow controllers, to modify the inlet dampers to maintain the proper air flow for combustion. These are adjusted by the master controller.

• Furnace draft regulators, to modify the draft of the boiler outlet damper in accordance with the master controller. Power units also control the fuel supply in accordance with the master controller.

• Flow meters, which measure the quantity of water entering each boiler.

For each expansion tank:

• Remote liquid level indicators, which indicate the level of water in the tanks. Indicators are directly on the instrument panel in addition to the local gage steam readings at the tanks.

For each system:

• Btu meters, which combine and integrate the water flow with the difference between entering and leaving temperatures to record the total heat gained.

• Water flow meters.

• Compressed air flow meters.

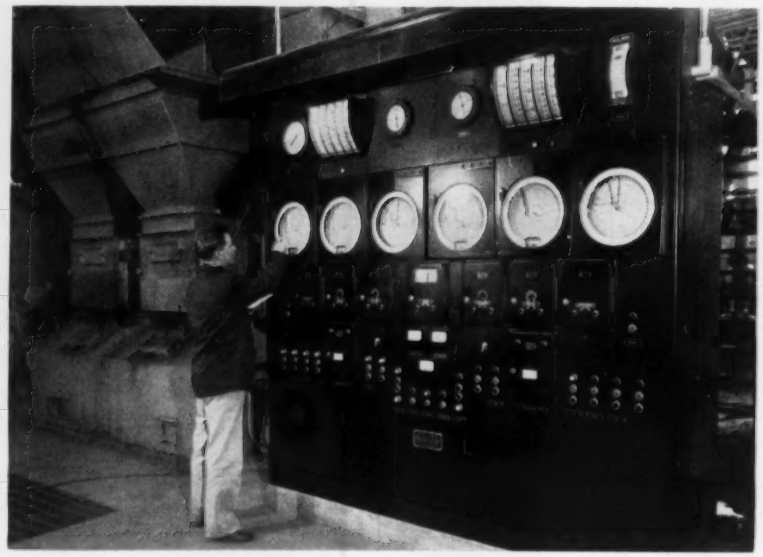
• Temperature recorders.

• Ammeters and pushbuttons for all pumps.

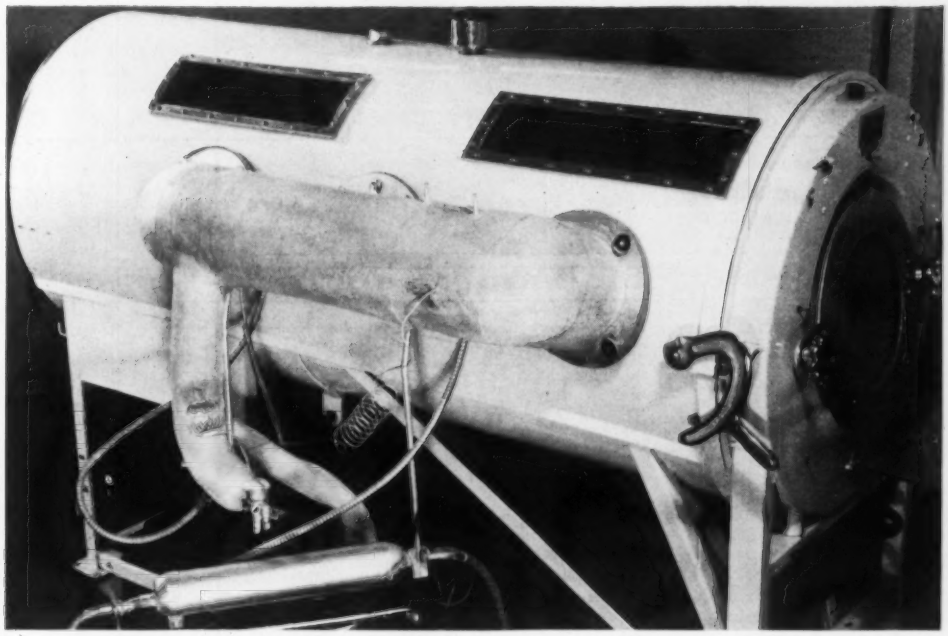
Also:

• Gages for each electrostatic precipitator, which has an air flow capacity of 1605 cfm.

• Alarm panel, containing a 30 circuit alarm connected through a wiring system to almost every operating device in the boiler house. An alarm rings and a light glows on the failure of each instrument. Provision is made to stop the alarm from ringing, while the light remains on until the danger condition is corrected.



CONTROL BOARD records and controls the system's overall activity. Tapes and gages spell out air and coal feed, temperatures, pressures, water flow, smoke, draft, and their meaningful correlations



1 AIR CONDITIONED IRON LUNG solves problem of eliminating body heat in high temperature, high humidity. Air ducts are attached at service ports. Cover is removed to show water cooled condenser in series with air-cooled condenser

How To Air Condition an Iron Lung

Conditions within the respirator favorable for the physiological removal of metabolic heat — with room temperatures as high as 120 F and relative humidity of 60 percent — have been experimentally established with a 1/3 ton condensing unit

By Tohru Inouye
Research Assistant
Department of Medicine
University of Illinois

DURING THE HOT SUMMER a few years ago, we observed fevers over 107 F in patients with acute poliomyelitis in "iron lungs." This observation prompted us to seek a means of cooling to dispose of body heat.

In comfortable rooms an "iron lung" — respirator — poses no problem of body heat elimination. In hot rooms the reverse is true.

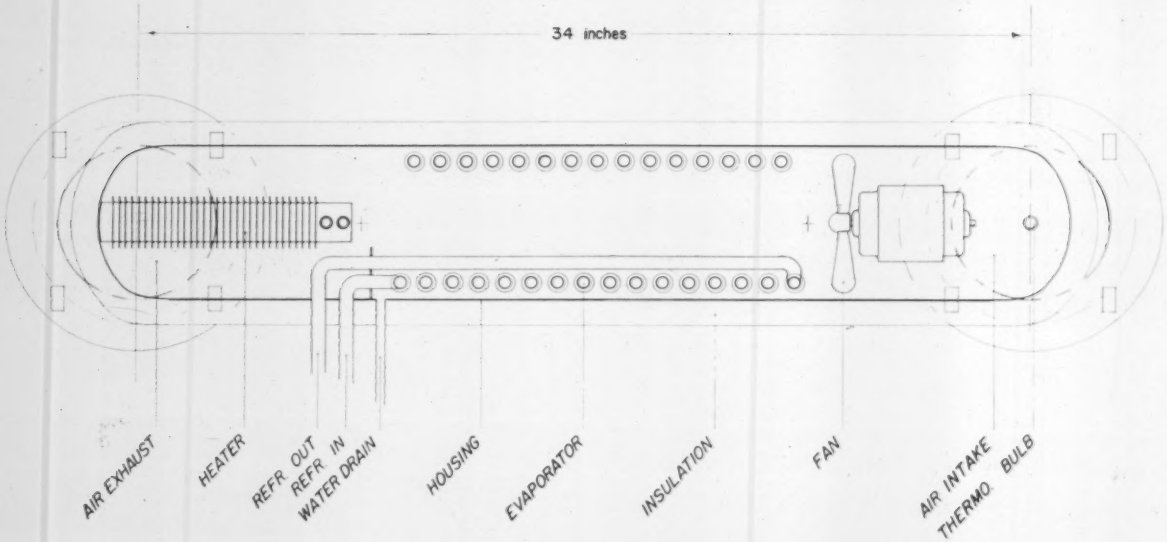
We designed and tested three methods of cooling the respirator: (1) an evaporator permanently installed inside the respirator, (2) in two stages, with the first by direct expansion outside, followed by a secondary heat exchange inside the respirator, and (3) by circulation of air from the respirator through a removable duct housing the evaporator and back into the respirator.

For ready interchangeability and maneuverability of the temperature control equipment, the third method was refined for use with a standard respirator.

System Is Airtight, Insulated

The air handling equipment shown in Fig. 1 is attached by flanges at two service ports. The main portion of the unit is a 6 in. ID tubing, on either end of which are 90 deg elbows with welded flanges. The entire system is airtight and insulated with 1 in. hair-felt covered with plaster.

The air temperature controlling device in the air handling unit is shown in Fig. 2. The duct contains the following components from air intake to exhaust: thermostatic bulb, tube axial fan, evaporator, water dam and drain, and electric heater. A five blade, 5½ in. fan is powered by a series wound motor with maximum speed of 10,000 rpm at 115 volts.



2 AIR CONDITIONING EQUIPMENT for the "iron lung" is shown here in longitudinal section. The components from the air intake to the exhaust are: thermostatic element, fan, evaporator, water drain, and heater

The evaporator made of ½ in. ID × ¾ in. OD integral finned copper tubing 20 ft long is a coil with an inside radius of 2 in. A 500 watt — 1700 Btu per hr — finned, airblast, electric heater is fitted at the exhaust end.

"Freon 12" is the refrigerant used in a 1/3 ton reciprocating compressor. A watercooled condenser is arranged in series with the aircooled condenser to prevent discharge pressures exceeding 150 psi.

How System Is Controlled

The control of temperature is moddulated through a thermostat actuating a single pole, double throw relay. When the temperature of the intake air exceeds that indicated by the setting of the thermostat, the relay opens the electrical circuit to the heater and closes the one to the compressor motor. The reverse occurs when the temperature of the intake air falls below a 1½ F differential of the desired temperature.

A pressure control opens the electrical circuit to the compressor motor when the suction pressure falls below 25 psi to prevent ice formation on the evaporators and closes the circuit when the pressure rises to 45 psi.

Simulate Body Heat Load

The air handling unit attached to the respirator was tested in a psychrometric room at a relative humidity of 60 percent and a dry bulb temperature of about 80, 90, 100, and 120 F. The unit operating with an air flow rate of approximately 225 cfm — equivalent fan speed of 7000 rpm — was tested for maximum cooling capacities with the respirator in and out of operation.

The respirator, when in operation, is cycled 14 times per minute over a pressure range of +2 to −10 in. water gage, with an internal heat load of 340 Btu per hr to simulate heat produced by a patient. This heat was generated from an electric heater placed where the patient would lie.

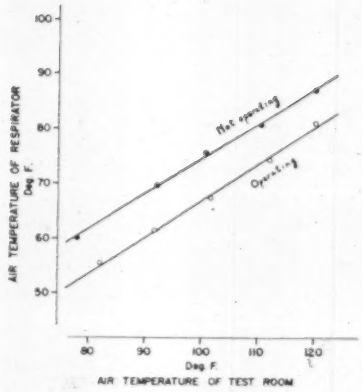
Measurements were made of relative humidity, air and surface temperatures inside and outside of the respirator, and the air temperature of the intake and exhaust of the air handling equipment. All temperatures were measured with thermocouples.

18 To 39 F Cooler in "Lung"

The temperatures of the air and surfaces inside and outside the respirator are summarized in Table 1 with the air handling unit functioning at maximum capacity with and without operating loads on the respirator. The relative humidity inside

• When an air conditioning contractor asked "How do you air condition an iron lung?" (See HPAC, April 1954), the manufacturer of the lung replied that it seemed more practical to air condition the room than the iron lung itself. He explained that, since room air passes through the chamber some 15 times per minute, temperature and humidity in the lung closely approximate conditions of its surrounding atmosphere.

However, Tohru Inouye maintains that, while there is no problem of eliminating body heat from respirators in comfortable rooms, air conditioning of iron lungs is necessary in high temperature, high humidity conditions, especially for patients with fevers.



3 MINIMUM TEMPERATURES obtained inside the respirator in and out of operation, at various air temperatures of the test room, are shown here.

the respirator was 42 percent and 26 percent for outside environments of 60 percent at 77½ F and 120 F, respectively. They correspond to an 18 percent and 34 percent lower relative humidity inside than outside the respirator. The water which condensed on the evaporator was forced out through the drain on the positive pressure cycle.

The temperature of the inside surface of the top of the respirator was approximately 20 F lower than the air temperature of the psychrometric room, 2 F to 4 F lower than the outside surface, and 6 F to 13 F higher than the inside ambient air. No condensate formed on the inside.

The ambient temperature inside the respirator in operation was about 33 F and 18 F lower than that of the psychrometric room of 120 F and 78 F, respectively. The corresponding reading inside the respirator while not in operation was about 39 and 27 F lower than that of the test room of 120 F and 83 F, respectively. The relationships are illustrated in Fig. 3, in which is plotted the air temperature inside the respirator against that of the psychrometric room.

The slopes of the lines are 0.63 and 0.68 with the respirator in and out of operation, respectively. The minimum respirator temperatures for any environment were reached within 1½ hours, with the major portion of the fall in temperature completed in ½ hour.

The air temperature inside the respirator was about 1 F to 2 F below that of the intake of the air handling unit and about 11 F to 23 F above that at the exhaust. The lower gradients were observed at the lower rather than at the higher environmental temperatures.

The small differential in air temperatures between the intake and the ambient of the respirator is explained by the position of the thermocouple measuring the air temperature; it was placed to the midpoint of the trunk of a patient lying in the "iron lung". It was about 1 ft from the intake and about 3 ft from the exhaust of the air handling unit.

Air Currents Not Objectionable

The air handling equipment maintained an environment inside the respirator adequate for elimination of body heat. The conditions were favorable for heat loss by evaporation, radiation and convection in all test environments as warm as 110 F and by convection and evaporation at 120 F. The inside environment which would not be suited for optimum comfort was not uniform. The air temperature was lower than the surface temperature; the air at the foot end of the respirator was cooler than that at the trunk end.

Air movement of approximately 225 cfm through the air handling equipment would result in an air turnover inside the respirator at about 15 times per minute.

The air handling equipment was designed to function at any level of temperature between the minimum limits to a few degrees above the ambient environment. This was advisable, not knowing at the present time the heat transferred into the respirator through the body from the head and respiratory surfaces exposed to the outside environment and the levels of ambient temperatures within the respirator necessary to control fever.

TABLE 1—TEMPERATURES of air and surfaces inside and outside of respirator in and out of operation, in a psychrometric room maintained at 60 percent relative humidity with different dry bulb temperatures, are shown here. Relative humidities inside the respirator are also tabulated.

Measurement	Temperature of Psychrometric Room									
	80 F		90 F		100 F		110 F		120 F	
	Not Operating	Operating[1]	Not Operating	Operating[1]	Not Operating	Operating[1]	Not Operating	Operating[1]	Not Operating	Operating[1]
Surface[2]										
Inside	61.9	65.6	72.2	77.0	79.7	84.1	85.5	88.4	94.5	98.7
Outside	64.4	67.8	74.4	79.6	83.4	86.8	88.5	90.7	97.6	102.3
Ambient Air[3]										
Inside	55.6	60.1	61.5	69.7	67.5	75.8	74.4	80.8	81.4	87.0
Outside	82.6	77.5	92.1	92.4	101.8	100.7	112.5	110.4	120.0	120.0
Air Handling[4]										
Intake	56.4	61.7	73.3	72.4	70.0	76.8	76.6	80.1	82.3	88.4
Exhaust	44.6	47.4	45.8	57.2	—	—	60.2	65.7	58.8	67.1
Relative Humidity, percent[5]										
Inside Respirator	42	42	28	36	34	40	32	35	28	26

[1]The respirator was cycling 14 times per minute over a pressure range of +2 to −10 in. of water in addition to a 340 Btu per hr internal heat load.

[2]Surface temperatures of the respirator were measured on the top at midpoint of the lengthwise dimensions.

[3]Ambient air temperatures of the outside — psychrometric room — were measured 12 in. above the respirator and of the inside on the center line of the respirator 12 in. from the head end.

[4]The temperature of the intake and exhaust of the air handling unit were measured at the center of the opening in the plane of the flange.

[5]The relative humidity in the respirator was measured by a hair-type hygrometer at the same location as the ambient temperature.

1 NEW CHURCH — which features "open space" architecture — will become the social hall when the new sanctuary is built. The large room is comfortably heated and ventilated without drafts, by means of the perimeter diffusers along the walls. Return air intake is seen in the furnace room wall at the left

New Church Heated by Large Sub-Floor Duct System

• Warm air from a 1 million Btu per hr furnace is circulated through a sub-slab central duct and through branches to a vitrified clay tile ring 8 ft from the walls around the perimeter. From the tile ring, the air moves through lateral branches, warming the floor, to air boxes below window sills. By continuous blower operation, air is delivered up through diffusers in window stools and "scrubs" the windows and outside walls, preventing the cool air from dropping to the floor. The church is controlled as a single zone. Future air conditioning and future additions to the present structure are provided in the design of the heating system.

By B. A. Kosarin

National Heater Co., Inc.
Arnold A. Kosarin & Associates

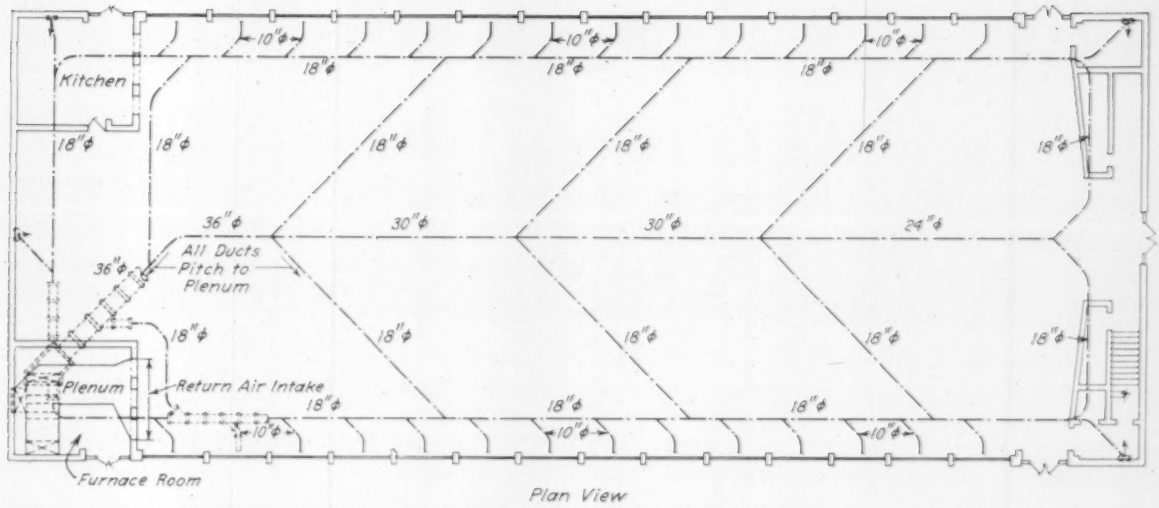
CLAY TILE and concrete pipe are used for distributing the warm air in the perimeter system for the new St. Cyril of Jerusalem Church near Detroit.

The heating and ventilating requirements for this new church demanded that the concrete floor be warm, with no floor drafts, and with uniform air temperatures; that outdoor air be admitted for ventilation; and that the system be quiet.

A floor panel-convection system using the perimeter principle was decided upon. Warm air is delivered into a distribution plenum below the furnace. From the plenum, it is distributed into a central concrete duct extending the length of the building. Lateral branches are connected to the clay tile perimeter duct, which extends around the building about 8 ft from the outside walls. The duct system is shown in Fig. 2.

At each window along both long outside walls, the warm air is supplied from the perimeter duct to air boxes below the window sill and through a diffuser in the window stool and into the church.

The system was designed for continuous blower operation so that uniform temperatures would be maintained by admitting warm air along the outside walls below the windows.



2 WARM AIR SUPPLY SYSTEM is underground. Center duct is concrete pipe. Perimeter duct is virtrified clay tile. All ducts pitch down to plenum

The constant scrubbing of the outside walls and windows increases the air temperature near the glass surface, thus preventing the cool air from dropping to the floor, causing drafts.

The warm air diffusers, installed on 10 ft centers, are 3 in. by 72 in., large enough to minimize air noise, reduce static pressure and insure proper diffusion of warm air along the outside walls. This vertical discharge of warm air also increases the temperature at the outside walls above the dew point, preventing condensation.

The narthex and individual rooms around the building are similarly heated with diffusers around outside walls.

Maintain Positive Air Pressure

Air returns through the church to large return air intakes in the walls of the furnace room. The only return air ducts used are those that connect the return air intakes to the furnace.

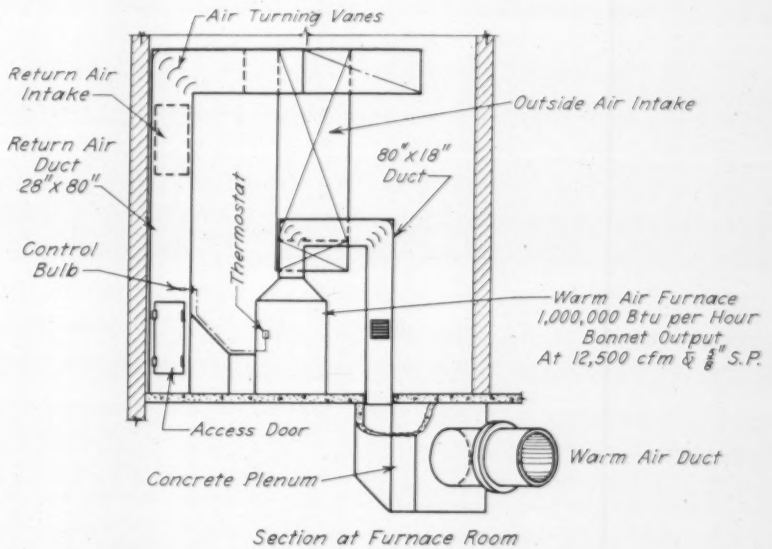
The absence of air ducts in the occupied area gave the architect a free hand. This is important where the spaciousness of "open design" is the basic architectural theme, which was necessary in this installation, with eventual conversion to auditorium use. Conversion can be accomplished with no change in, or interference from the heating and ventilating system.

Dampers provide varying amounts of outside air, and since there are no exhaust fans except in the kitchen and toilets, the building is always under pressure. This pressure is automatically maintained by a relief damper, regardless of the amount of outside air introduced. Infiltration is minimized since air from the church is constantly expelled to the outside through exfiltration. This slightly positive pressure further simplifies the heating of such areas as lobbies, and foyers, with the particular requirements for air locks and unusual heat loads.

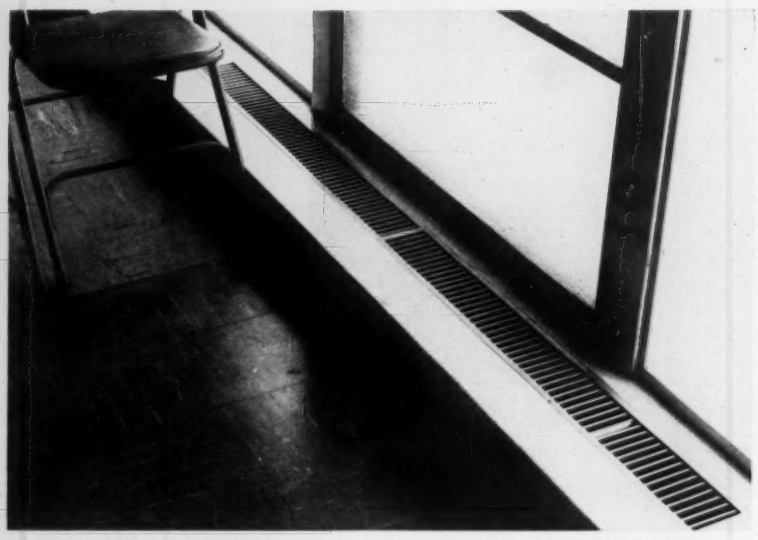
The relief dampers are equally important in the summertime, when 100 percent outside air is admitted, and the inside air is discharged.

All of the air going to the furnace is filtered.

The air distribution system was designed to accommodate air con-



3 OUTSIDE AIR is provided in varying amounts by dampers, up to 100 percent for summer ventilation. A relief damper maintains a slightly positive pressure regardless of the amount of outside air introduced



4 VERTICAL DISCHARGE of warm air eliminates draft and also raises temperature at outside walls above dew point, preventing condensation

ditioning in the future. The addition of a compressor and expansion coil will furnish dehumidified and cooled air with no changes necessary in the dampers and diffusers. The size and number of the supply ducts make possible the use of increased quantities of air with no audible air noise.

Calculations for heating, make-up air and ventilation, indicated the need for a furnace capable of delivering 1 million Btu per hr, with the fuel to be used as No. 2 oil, with blower capacity of 12,000 cfm at 5/8 in. water gage external static pressure.

Treat Church as Single Zone

The entire church is controlled as a single zone. The thermostat, in the church proper, acts as a switch to energize the blowers. A thermostat in the return air duct energizes the burner circuit through the induced draft-proving control. This insures proper burner operation as outside temperatures vary and are reflected in return air temperature differences.

A modulating burner was considered not necessary because of the thermal inertia of the concrete slab which would level off the temperature peaks that are common with intermittent burner operation.

A full season's operation has substantiated the system's design.

Coupled with good design must be competent and careful installation. The General Air Handling Co. installed the system.

While the design represents a marked departure from more conventional systems, installation presented no problems to the heating contractor. To insure complete compliance with the design concepts, meticulous design details were incorporated in the mechanical prints. This also served to protect the contractor from possible arbitrary field decisions.

Install Edge Insulation

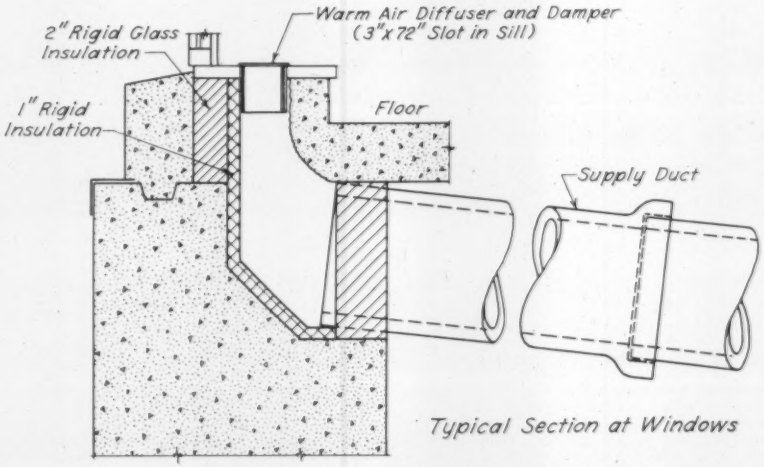
Since it was imperative to minimize heat loss from the perimeter air ducts through the outside walls, thought had to be given to sufficient insulation. One in. rigid insulation backed by 2 in. thick rigid glass insulation provided the needed thermal barrier.

Maintain Even Temperatures

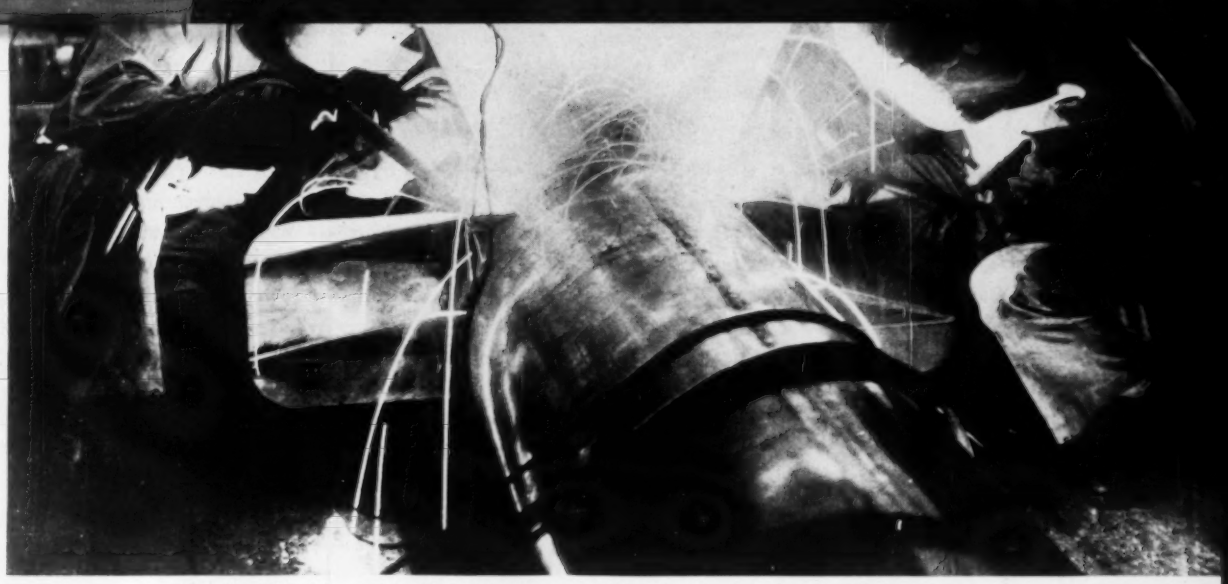
Balancing the system proved to be simple since the primary consideration was the equalization of air quantities through the diffusers. After the system came up to control temperature, differentials in temperature between the diffusers were less than 10 F. Continuous blower operation has proved to provide comfortable conditions throughout the building by minimizing temperature differences between the floor and ceiling.

Due to a higher mean radiant temperature along the outside walls, comfort was attained with a thermostat setting lower by 5 F than that for conventional warm air systems. This reduced setting has resulted in reduced fuel costs.

The consulting engineer was Octavius Germany, and the architect was Walter J. Rozycki.



5 EDGE INSULATION of 1 in. thickness backed by 2 in. thickness of rigid glass insulation forms thermal barrier to reduce heat loss from perimeter duct and concrete slab



1 THE SIZE OF ALUMINUM PIPE is no problem for the inert gas shielded metal arc welding process. Though these men are working in a shop, the only extra requirement for field work would be windshields. Open-end and box-like, the shields surround the area to be welded to protect the inert gas shield from stray air currents or wind

ALUMINUM PIPE FIELD WELDING SPEEDED BY

Inert Gas Shielded Metal Arc Process

- **fast welding speeds**
- **good heat concentration**
- **removal of surface oxide**
- **prevention of reoxidation and absorption of gas by the weld metal**

By R. A. Stone
Process Engineer,
Air Reduction Co.

and

W. H. Wooding
Superintendent, Metals Section
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ALUMINUM and aluminum alloys, because of their light weight, moderate strength, good corrosion resistance and other desirable properties, form a versatile group of engineering and construction materials, including tubing and pipe.

One of the factors largely responsible for the increased use of these materials has been the introduction of vastly improved fabricating techniques during the past decade. The inert gas shielded arc welding process is a major contribution to the fusion welding of aluminum and its alloys.

Aluminum Challenges Welding

Aluminum has several characteristics which are annoying and troublesome to fusion welding processes. Chief among these are: (1) its low melting temperature and high thermal capacity; (2) its high rate of heat conductivity, oxidation, and thermal expansion and contraction; and, (3) its affinity to absorb gases when molten, causing porosity on solidification.

To overcome these difficulties, the fusion welding process must provide a highly concentrated source of heat, a means for the removal of oxidized metal and the prevention of reoxidation during welding. Also, a protective cover must be provided to prevent the absorption of gases by the molten metal. Though the earlier processes — gas welding and carbon and metal arc welding — pro-

Aluminum, until recently a troublesome challenge to fusion welding, is one no longer, thanks to the successful development of the inert gas shielded metal arc welding process. Using very high welding current densities, the electrode wire automatically drawn from a spool, is fed into the arc and deposited on the work, which is surrounded by a shield of inert gas. Fast welding speeds, good heat concentration, the removal of surface oxides, and the prevention of re-oxidation and absorption of gas by the weld metal are provided by the process.

Already the inert gas process has proved adaptable to field fabrication of piping. Several thousand feet of aluminum piping for the oil industry have been successfully field welded by the use of this process. With the same techniques and precautions used in the workshop — except for the extra requirement of windbreaks to protect the inert gas shield — jobs have progressed without a hitch, even in winds up to 40 mph.

On one job where a manual gun portable welding machine was used, the moving pipe line was pulled along the ditch by a tractor, as new lengths of pipe were welded, all at one station. Used on another job was an automatic welding machine, operated by remote control push buttons. Welders were quickly trained, and no difficulty was experienced in the use of the process. Tests show that the weldments are of good quality and free of defects.

• here's how inert gas process was used

THE inert gas shielded metal arc welding process has proved successful in a number of actual field construction jobs. Among them are an aluminum alloy pipe line for sour crude natural gas and an aluminum high-pressure gas transmission line.

For the aluminum alloy pipe line some 3½ miles of 40 ft lengths of 4 in. pipe, 0.125 in. thick, were butt welded, using a joint design similar to Type 1 in Fig. 3.

Internal Expanding Jig Used

On this job, novel use of an internal expanding jig, to line up pipe ends, held the pipe ends in place during welding and acted as a backup ring to prevent weld metal from running through and creating icicles inside the pipe. Upon completion of the weld, the jig was collapsed and removed from the pipe by means of a long extraction rod.

All Welds Made at One Station

All the welds were made at one location, and the pipe was pulled along the ditch with a tractor. This saved a great deal of time in moving of equipment and materials. The first two lengths of pipe were positioned in dollies and aligned with the interior jig. After alignment, a windbreak was placed over the joint and the edges were tack welded.

After the butt weld was completed, the pipe was pulled forward. Then the next 40 ft section was readied for welding. The joints received considerable rough handling, since the lengths fabricated in this manner were 1750 ft long. These lengths were joined together using the flanged bell welded joint similar to Type 2 in Fig. 3. This type does not require a backup ring since the pipe inserted into the flanged bell serves this purpose.

Weld Line at 300 Ft Per Hour

The pipe line was welded together at the rate of approximately 300 ft per hour. No particular difficulties were involved in the use of the inert gas metal arc process. An experienced arc welder quickly masters the art of welding in the downhand and other positions. The operator has merely to point the gun at the joint, pull the trigger, and touch the electrode wire to the work. Welders were readily trained to use the process. With normal precautions, they deposited sound weld metal with a minimum of effort.

In the beginning, the fabrication of the pipe line proceeded at a rate of from 18 to 20 minutes from joint to joint. As the job progressed, the joint to joint time dropped to as low as 6½ minutes. Actual welding time per joint was approximately 2 minutes.

V Joint Used for Larger Pipe

On the aluminum high-pressure gas transmission line, a different type of welding machine, using the stringer bead technique, was used.

The operating pressure for this line is 500 psi. Here, 10½ miles of 8⅝ in. OD × ¼ in. wall 63S-T6 extruded aluminum pipe were welded. The joint employed was a 60 deg "V" with a root face of 1/16 in. Excellent results were obtained by depositing

vided these essentials in some degree, it was not until the advent of the inert gas shielded arc welding process that the satisfactory fusion welding of aluminum could be accomplished without undue difficulty.

Inert Gas Process Developed

During World War II, the need for a method for the fusion welding of a magnesium-aluminum alloy led to the final development and perfection of the then little known inert gas shielded arc welding process. This process, currently known as the inert gas shielded tungsten arc welding process, was found suitable and was adopted for the fusion welding of aluminum and aluminum alloys.

The welds were produced without flux. They were of good quality and free of porosity. And they could be made with ease in all positions of

(*Continued on page 116*)

2 READY TO BUTT WELD two 40 ft lengths of 4 in. aluminum alloy pipe for a sour crude natural gas line, this crew is using a portable welding machine with manual gun designed for field use. The windbreak has been removed to allow the photograph to be taken

successfully on two field jobs

the circumferential butt welds in four passes. The weldments were of good quality and hydrostatic tests of qualification sections withstood 1800 psi before failure, which occurred in the 43S weld deposits.

Weld in Winds Up To 40 Mph

The welding machine used on this job is designed primarily for the field welding of gas gathering and oil transmission lines of aluminum. A consumable aluminum wire electrode is fed by drive rollers from a reel to a welding nozzle. At this point, the wire, weld metal, and base metal are protected from oxidation by a shield of inert gas (argon, helium or a mixture of the two). A windshield around the nozzle insures a complete gas shield for outdoor welding. The machine has performed satisfactorily in winds up to 40 mph with this shield in place.

The welding machine weighs approximately 200 lb and measures 4 ft in diameter by 2½ ft in width. A lifting eye is provided for raising and lowering the unit over the work. Once the machine is clamped to the pipe, the welding gun circles it by means of a motor driven worm gear. Adjustments are provided to accommodate piping with diameters of 4 in. to 8 in. and wall thicknesses of ⅛ in. to ¼ in.

Operated By Push Buttons

Welds initiated at the top of the pipe proceed downward to the bottom. The operations are performed by an operator through pushbuttons located at a remote control station. There are two welding buttons — one for welding clockwise, and another for welding counter-clockwise. Depressing either of these simultaneously starts shielding gas flow and automatic speedup of the gasoline welding generator, after which the wire feed and movement of the head begins, initiating the arc. Upon reaching the end of the weld, the operator releases the button, which stops the weld. By separate head motion buttons, the gun is positioned for the next weld pass and the process is ready to be repeated.

Time Was 3 Minutes per Joint

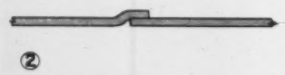
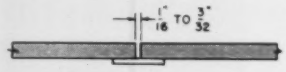
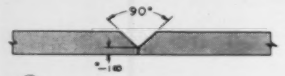
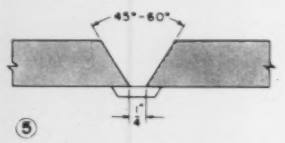
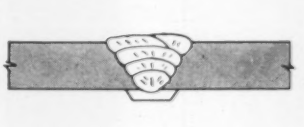
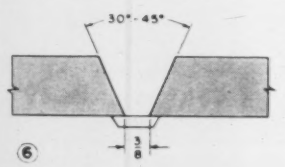
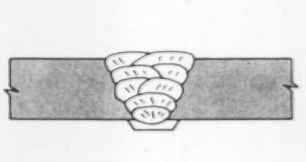
Welding current of approximately 275 amps used with a 1/16 in. electrode resulted in a total weld time per joint of about 3 minutes. During one 8 hour day, over 4100 ft of pipe was completely welded by one operator and a helper using this automatic machine. In addition, a second welder was also employed using the manual inert gas shielded arc welding equipment to tack weld the pipe together ahead of the machine.

Tests Reveal No Defects

On both of these field fabrication jobs, the welding procedures and precautions followed were essentially the same as those used in shop work. However, for field work, windbreaks are a necessity to prevent wind from disturbing the inert gas envelope surrounding the welding arc.

The welds deposited by either manual or automatic procedures were of good quality. When tested, the installations were found free of welding defects.

WELD JOINT DESIGN FOR ALUMINUM PIPE AND TUBING

JOINT DESIGN	MATERIAL THICKNESS	CURRENT (AMPS)	BEADS REQUIRED	REMARKS	WELD
①	1/8" TO 3/16"	175 - 200	1	COPPER BACKUP	
 ②	1/8" & UP	200 - 225	1 OR MORE	NO BACKUP REQUIRED	
 ③	1/4"	200	2	BACKING STRAP OR COPPER BACKUP	
 ④	1/4" TO 3/8"	200 - 225	3 OR MORE	BACKING STRAP OR COPPER BACKUP	
 ⑤	1/2" TO 3/4"	220 - 250	3 OR MORE	ALUMINUM BACKING STRAP 3/16" x 3/4"	
 ⑥	1" & UP	220 - 250	8 OR MORE	ALUMINUM BACKING STRAP 3/16" x 3/4"	

3 VARIOUS JOINT DESIGNS have been used successfully for welding aluminum pipe, some of which are shown here. Butt joints (Types 1 and 3), welded from one side, require backup rings. (With Type 3, either backing strap or copper backup can be used.) V joints (Types 5 and 6) require backing strap; either backing strap of backup may be used with Type 4

welding. Qualitywise, they were superior to aluminum welds deposited by other fusion welding processes.

This advance in the art of welding aluminum was rapidly followed by the development of a second process which also utilized inert gases for the shielding of the welding arc and molten weld deposit. This second process employs a metal electrode of the consumable type. The electrodes are of bare wire and are of compositions similar to that desired in the weld deposits.

In operation, the arc, the terminal end of the electrode, and the pool of molten weld metal are completely enveloped in an inert gas shield of either argon, helium, or mixtures of both. Using very high welding current densities, the electrode wire is automatically drawn from a spool, fed into the arc and deposited on the work without appreciable loss. This process is currently referred to as the inert gas shielded metal arc welding process.

Proves Answer for Aluminum

The operating characteristics of the inert gas shielded metal arc welding process are especially desirable for the fusion welding of aluminum and aluminum alloys for several reasons:

1) The high electrode current density provides good heat concentration to overcome the high thermal capacity and high heat conductivity of aluminum.

2) The high current density provides fast welding speeds, which are a means for overcoming the difficulties attendant with low melting temperatures and the high rate of expansion and contraction.

3) Operating on direct current, reversed polarity, the cathode spot is on the base metal, where it effectively removes the surface oxide in

way of the weld deposits.

4) The inert gas shield blankets the arc, molten metal and adjacent areas to prevent re-oxidation and absorption of gas by the weld metal.

The selection of the shielding gas depends upon the operating characteristics desired. Helium provides a "hotter," more forceful arc. It is generally used to obtain the deep penetration required for the welding of heavy sections or for welding at fast travel speeds.

Argon produces an arc which is more quiet and has less drive, making it more suitable for light sections. When the characteristics of both gases are desired, mixtures of helium and argon have been used with success.

With reasonable care, with high purity inert gas, and with properly cleaned electrode wire, aluminum and aluminum alloys are readily joined by fusion welds of good strength and quality. Several of the more popular aluminum alloys which are successfully welded by this process are listed in Table 1, together with the type of electrode used for each.

Typical mechanical properties obtained for such weld metal and aluminum alloy weldments are presented in Table 2. Of particular interest are the 54-S and 56-S aluminum alloys. While they are of recent vintage and have not been fully explored, the 54-S material has been qualified by the American Society of Mechanical Engineers' Boiler and Pressure Vessel Code (Case No. 1174) for use in the construction of a welded unfired pressure vessel.

Meets Field Requirement

The inert gas shielded metal arc welding process is readily adaptable for field fabrication and construction. The equipment, by virtue of its weight, is reasonably portable. However, it does require a source of inert gas, a d-c welding generator, and an a-c voltage supply for operation of the electrode feed mechanism.

Machines of this type are produced by several manufacturers of welding equipment. In the main, they consist of a variable speed wire feed mechanism, a reel for containing the electrode welding wire, and a welding gun in which the welding current is transferred to the wire and the inert gas is directed to properly shield the arc. The gun assembly is equipped with a trigger-like starting switch, which turns on welding current and shielding gas, and sets up the control circuit for feeding wire as soon as an arc is struck.

One type of water-cooled machine, intended for welding currents up to 500 amps, weighs less than 85 lb, without welding wire. For field use, a water recirculator is necesary.

The opinions expressed in this article are those of the authors and do not necessarily represent the views of the Air Reduction Co. or the Department of the Navy.

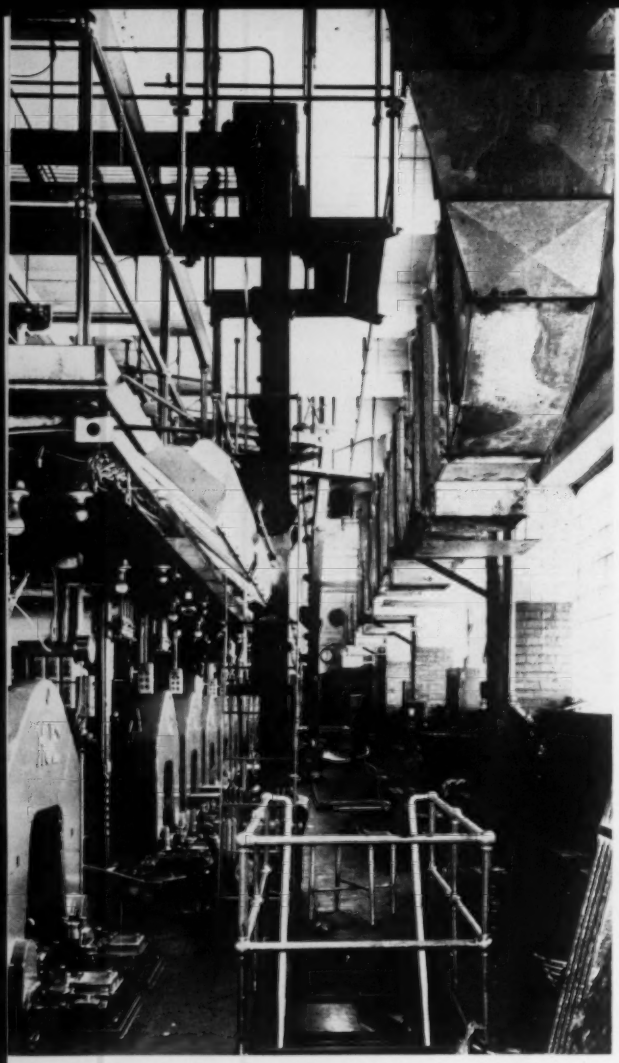
4 CLAMPED TO THE PIPE, this field welding machine, which is operated by push button control, circles the pipe by means of a motor-driven worm gear. The pipe, of 1/4 in. thick extruded aluminum, is 8⅝ in. OD

TABLE 1—ALUMINUM ALLOYS which are successfully welded by the inert gas shielded arc metal welding process require various types of welding electrodes, as shown here

Type Aluminum Alloys		Type Welding Electrode	
Old Alloy Designation	New Alloy Designation	Old Alloy Designation	New Alloy Designation
2-S	1100	2-S	1100
52-S	5052	54-S	5154
54-S	5154	54-S	5154
56-S	5356	56-S	5056
61-S	6061	43-S	4043
63-S	6063	43-S	4043

TABLE 2—MECHANICAL PROPERTIES obtained for weld metal and aluminum alloy weldments by the inert gas shielded metal arc welding process indicate satisfactory service for pipe lines so welded

Type Specimen	Weld Deposit	Plate Material	Tensile Strength, psi	Elongation, Percent in 2 in.	Bend Test, Deg Free	Bend Test, Deg Guided
			Deposited Weld Metal			
0.505 in.	2-S	——	17,900	25	——	——
All weld	43-S	——	22,400	8.4	——	——
metal	54-S	——	30,600	22	——	——
specimens	56-S	——	40,500	27	——	——
			Aluminum Alloy Weldments			
Transverse	2-S	2-S	13,100	——	180	180
butt weld	43-S	61ST6	27,500	——	——	——
tensile and	54-S	54-SH34	38,500	10.0	——	180
bend	54-S	61ST6	34,900	6.5	——	180
specimens	56-S	56-SH34	46,000	11.5	——	180
	56-S	61ST6	33,200	6.5	——	180



1 SPOT COOLING through openings in supply duct keep operators comfortably cool in press room

YEAR 'ROUND AIR CONDITIONING installed as part of a complete modernization program in the 83 year old Charlotte, N. C., *Observer* plant in 1952 has resulted in improved mechanical performance and increased efficiency and productivity of employees. In addition, operating and maintenance costs of the unusual system — which features partial spot cooling in five of the 10 zones — are estimated to be $2500 per year below the original estimate.

The cost of the entire system, including installation, was about $120,000. Operating and maintenance costs are about $5500 per year.

Power cost for the air conditioning alone is difficult to pin down, because it has not been isolated from the general power cost, and because other pieces of power consuming equipment were added at the same time. However, it is estimated that power for air conditioning costs about $3500 per year.

Maintenance, again, is difficult to isolate, but a liberal estimate is $2000

THE CHARLOTTE OBSERVER STORY

Partial Spot Cooling Cuts Cost of Air Conditioning Newspaper Plant

By C. B. Capps
Mechanical Superintendent
The Charlotte Observer
and
M. L. Hoglund
Manager, Refrigeration Sales Dept.
The Trane Co.

After two and a half years' operation, one of the first newspapers in the country to air condition its entire plant reports lower than estimated operating and maintenance costs and affirms the effectiveness of the partial spot method of cooling used in some parts of the building.

The staggered cooling cycle system, by which only areas in use are cooled, also reduced the load from an original estimate of 350 tons to 150 tons, thus enabling greater savings in first cost.

A 150 ton packaged hermetic centrifugal compressor chills water for a zone system of air conditioning units, from which air is distributed through ducts to all conditioned zones except the business offices. The offices are conditioned by individual room units which receive hot or chilled circulated water from the basement.

per year, since there has been practically no trouble with the basic system. In fact, almost all of this expense has been for replacement of throwaway type filters for the air handling units. Vaporized ink in the air in some zones tends to clog the filters rather quickly, and some of them have had to be replaced more frequently than was expected.

System Is Paying for Itself

Of course, most of the results of air conditioning are intangible and cannot be measured in dollars and cents. But after nearly three years, this system is seen to be paying for itself.

Air conditioning keeps the complicated mechanism of the presses operating much better. Also, it filters the greater part of the ink vapor which rises from the rollers that revolve at terrific speeds when the presses are printing 50,000 papers an hour.

In the composing room, air conditioning has eliminated dust and dirt as well as heat, keeps dirt from clogging up the critical mat channels on linotype machines, and prevents many slow-downs in production.

The management is convinced that air conditioning has helped all mechanical operations and has greatly increased the efficiency of employees in all departments, including the proof-rooms and the teletype department. The comfort level is much higher, and everyone is happy on the job.

Although there are no facilities for measuring increased productivity during the summer months, many of the editors and supervisory employees affirm that their own outputs have been perceptibly better and that the increased productivity of employees during hot weather has been remarkable.

Consider 10 Zones Separately

Because of the problems involved in trying to air condition an existing building — and likely some peculiar to a newspaper plant — a consulting engineer was called in to help study the situation and to prepare an air conditioning plan.

It was apparent from the beginning that different parts of the building presented dissimilar problems. So the areas to be air conditioned were broken down into 10 zones, each of which was then considered separately.

Standard design conditions for Charlotte are 95 F DB and 78 F WB. Over 350 tons of cooling capacity was calculated as necessary to hold inside temperatures in all zones to 80 F DB and 50 percent relative humidity. Since the cost for this would have been prohibitive, ways to reduce cost without seriously affecting the desired result were sought.

Staggered Cycle System Chosen

After considerable study — particularly of critical areas like the press, composing, and stereotype rooms — it was decided to cool only actual working areas in certain zones by means of "spot cooling." Also, since some of the zones were occupied mainly in the late afternoon and at night, the peak load on the central refrigeration equipment could be made considerably less than the sum of the maximum individual zone loads, by cooling only those areas in use.

TABLE 1—MAXIMUM COOLING LOAD on central equipment calculated for the 10 zones at different times permits staggered cycle system

Zone	Description	Tons of Cooling		
		Day	Night	24-Hours
1	Business office	18		
2	Mezzanine and first floor under mezzanine	26		
3	Editorial department			14
4	Third floor AP & rewrite offices and teletype room			20
5	Transportation department	16		
5A	Mail room		16	
6	Old composing room			20
7	New composing room			20
8	Press room		20	
9	Stereotype room		20	
10	Reel room		20	
	Total	60	76	74

Staggered cooling cycles, therefore, were chosen. See Table 1. Since *The Observer* is a morning newspaper, the night load is heavy, and this was in favor of balancing day and night loads. The estimated maximum daytime load was 134 tons; the maximum night load, 150 tons.

With the use of a 150 ton packaged hermetic centrifugal compressor refrigeration unit as the chilled water source, a system of zone coolers, or remote air handling units, was planned. From these units, air is distributed through ducts to all conditioned zones except the business offices, which are handled by individual room air conditioners.

Zone Units Condition Air

The zone air handling units are complete air conditioning units, which when provided with warm or chilled water heat or cool the air, remove moisture, filter dust and dirt, mix outside and recirculated air, and move the conditioned air to wherever it is needed.

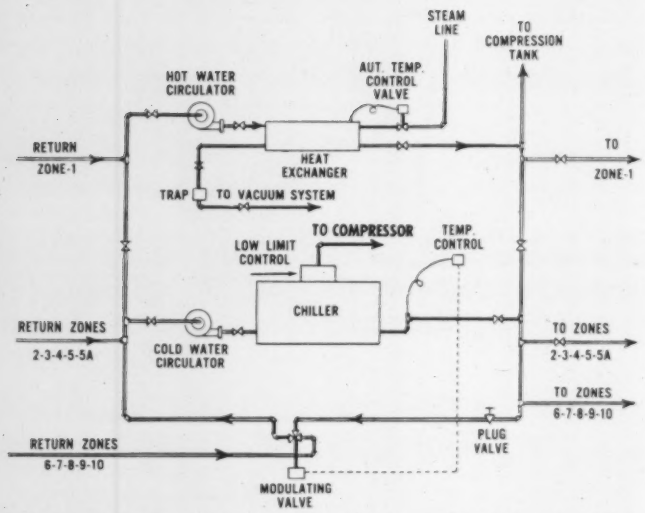
Spot Cooling Found Effective

After two and a half seasons of operation, the spot cooling method has proved an effective solution. The stereotype department — formerly the hottest area in the building — is now comfortable by the time the main work force comes on between 6 and 7 p.m. The press operators also testify to the effectiveness of spot cooling in the press room.

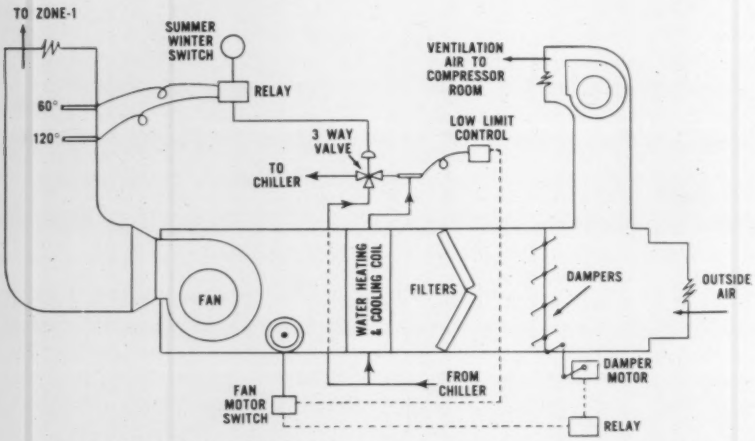
Enclose Ducts on Main Floor

Zone 1 on the main floor includes the business office and several private offices. For architectural reasons, no air ducts are exposed here. Existing steam radiators were replaced with room air conditioners, which provide both heating and cooling. These enclosed fan-coil air handling units receive circulated water from the basement — chilled water for summer cooling and hot water for winter heating.

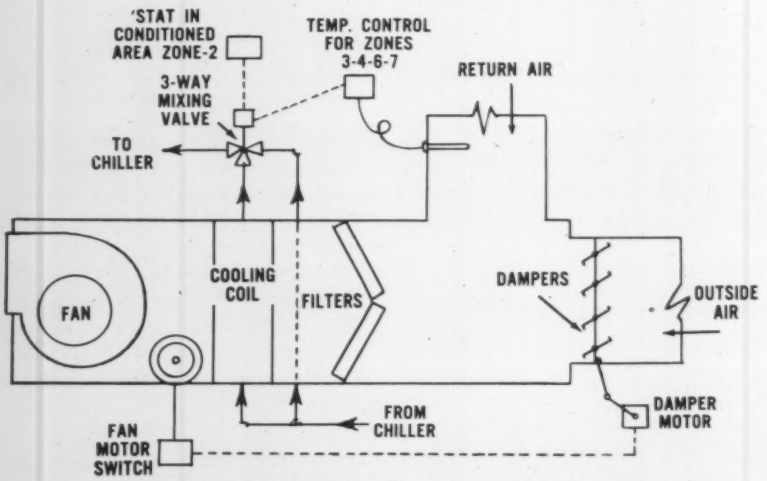
Fifteen room units are used. In addition to cooling, filtering, and dehumidifying recirculated air, they



2 ENTIRE SYSTEM combining zoned air conditioning units and individual room units is supplied hot or chilled water from basement



3 VENTILATING UNIT in basement conditions outside air for distribution to room units in zone 1 offices through ducts under the floor



4 AIR CONDITIONING UNITS, similar for zones 2, 3, 4, 5, 6, and 7, are controlled by thermostat which operates three-way mixing valve

one zone has 24 hour

also provide preconditioned ventilation air. This ventilation air comes from a large air handling unit in the basement which draws in outside air, conditions it and distributes it through underfloor ducts to all room units in this area. See Fig. 3.

How Basement Unit Operates

In the basement unit, outside air is either preheated or precooled, depending on whether hot or cold water is being supplied to the coil. The degree of heating or cooling is controlled by a three-way mixing valve, which is modulated by a remote bulb thermostat in the discharge air duct. It is adjusted to maintain ventilation air at about 120 F in winter and 60 F in summer. A damper in the outside air intake of this unit, controlled through an electric-pneumatic relay, opens when the fan starts and closes when the fan stops.

The fan may also be stopped by a low limit controller, whose temperature bulb is in the water line leaving the coil. If for any reason this water temperature should drop to about 40 F, this controller stops the fan, thereby preventing any risk of coil freeze-up.

The total capacity of the room cabinet units in zone 1 is sufficient to maintain design room conditions in the summer when supplied with 45 F inlet water at a 10 deg rise, and in the winter with water at 150 F or less.

Automatic temperature control is achieved by control of the water flow through each room unit. Room thermostats in various locations control one or a series of three-way pneumatic modulating water valves, which bypass circulating water on each unit.

Only daytime cooling is provided in zone 1.

Zone 2 includes a general office

air conditioning; others have it day or night only

area on the first floor and a mezzanine above. This area is supplied with conditioned air through ducts from an air handling unit in the basement. Ventilation air is taken from the same outside air duct which supplies the basement ventilation unit for zone 1.

Cool Office Areas Days

Temperature control in zone 2 is from a thermostat in the first floor office area below the mezzanine. This thermostat operates a modulating three-way mixing valve which controls the water supply to the coil of the air handling unit in the same manner already described.

A damper is installed in the outside air supply to the unit. This damper is positioned by a damper motor which is controlled by the fan starter. The damper remains closed when the fan is not operating.

Cooling in zone 2 is needed only during normal daytime working hours.

News Room Gets 24 Hr Cooling

Zone 3 on the second floor is the editorial department, which includes several offices and the large news room. A vertical floor-mounted air handling unit in the news room supplies cool air through overhead ducts. Since this department is staffed almost constantly, the cooling system operates 24 hours a day.

Ventilation air is drawn into the air handling unit through a duct from the nearest outside wall.

Temperature control in this zone is from a remote bulb temperature controller in the return air duct to the air handling unit. Other controls are the same as for the zone 2 unit.

Zone 4 takes in the occupied portion of the third floor, exclusively an office area. Housed here are the teletype machines which receive the news from Associated Press headquarters. The classified advertising department is also in this area. An air handling unit in one corner of this floor provides cool air to this zone around the clock through overhead ducts. Since the unit stands next to an outside wall, outside air is drawn in through a wall opening.

Temperature and damper controls in this zone are the same as for zone 3.

Day, Night Zones Change Over

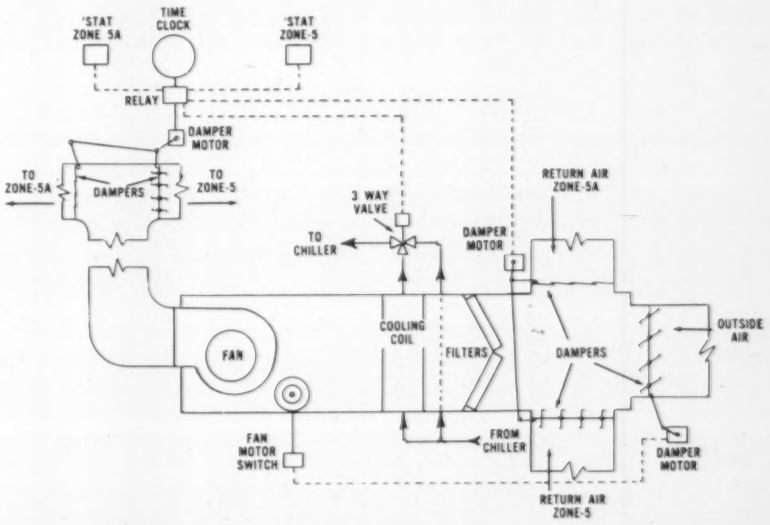
Zone 5 is the transportation department in a first floor wing, and zone 5A is the mail room which is directly above it. Since the transportation and shipping personnel work only in the daytime and the mail room operates in the evening, the air handling unit in this zone has an automatic day-night switchover. A 15 ton supplementary unit has been added in Zone 5.

An individual thermostat is installed in each area as shown in Fig. 5. The thermostats control the three-way mixing valve on the water coil through an automatic changeover panel in the mail room. The thermostats each control their respective zones.

Dampers in the cool air supply ducts to the two zones divert the air automatically to the desired area. Dampers in the return ducts are operated in the same manner. A relay permits this changeover to be accomplished simultaneously with the changeover of control of the thermostats.

The entire operation is controlled by a clock, and the changeover occurs automatically at 5:30 each evening.

The air handling unit is adjacent to an outside wall. Outside air is drawn in through a wall opening.



5 AIR HANDLING SYSTEM for zones and 5A — transportation department and mail room — has an automatic day-night switchover

Spot Cool Five Zones

The remaining zones, 6 through 10, include the portions of the plant in which spot cooling is used, since the total cooling load is too heavy to attempt to maintain design conditions at all times.

Zones 6 and 7 are the old and new composing rooms, where all type is set. The rooms contain 23 linotype machines, each of which has a molten pot of type metal maintained at 525 F by an individual electric heater. Before air conditioning, this was one of the most uncomfortable locations in the plant in the summer. Now, as a result of carefully planned ducts and outlets, it is pleasant, even though the 40 tons of cooling capacity — provided 24 hours per day by two air handling units in these zones — is not enough to maintain design conditions throughout these spaces.

In both zones, the units are next to outside walls, so outside air is drawn in through wall openings.

Temperature and damper controls are the same as for zone 3.

Press Room Has 160 Ton Load

Zone 8 is the press room, about 24 ft high, 28 ft wide and over 100 ft long. As in the composing room, complete air conditioning of the press room would have entailed a prohibitive expenditure. The 12 press units and two pairs of paper folders require a power input of about 500 hp. Also, additional heat is generated by friction on the ink distributing and printing rollers. Total maximum cooling load for this room was estimated to be between 150 and 175 tons.

Spot cooling is provided along the operating side of the presses. A cooling capacity of 20 tons is supplied, and the cool air from an air handling unit at one end of the room is distributed along the operating aisle by means of a low duct, as shown in Fig. 1. Two 20 ton units, suspended from the ceiling on the reel room level, spot cool the lower level. This method does an entirely satisfactory job and the press operators are quite comfortable.

A large proportion of ventilation air is required, and is drawn directly from a wall opening in the press room.

The air handling unit in the press room is equipped with a separate steam coil for winter heating.

A thermostat in the operating area of the press room controls a motor which positions face and bypass dampers in the unit, thereby regulating the amount of air passing through the steam or chilled water coils. A summer-winter switch reverses the damper motor's action.

Hottest Zone Is No. 9

Zone 9 is the stereotype department, where mats are made and the plates are cast and finished. This is ordinarily the hottest department of the plant, having a large stereotype metal furnace as well as two other furnaces. The metal is heated in these furnaces to 600 F.

Since a considerable amount of air must constantly be exhausted from this area to eliminate the fumes and heat, there was some problem in doing this without wasting cooled air. Suction fans in one of the outside walls now draw off most of the heat and fumes. Also, breather pipes pull outside air across the furnaces.

Cool air, provided to this zone at night only, is distributed by ductwork from a large air handling unit in the room. This unit handles recirculated air only. Controls are simpler than for the other zones, since there are no outside air dampers in the unit.

Zone 10 is the reel room in the basement. Approximately 900 tons of newsprint paper is stored here on large rolls. Since the area immediately above is a concrete parking lot, the heat load by evening is great. But again spot cooling from carefully placed ducts is doing an adequate job of keeping working stations comfortable.

Two air handling units in the equipment room provide up to 20 tons of cooling capacity to this zone during the evening, when cooling is needed most. These units also have steam coils and provide warm air in the winter.

In all zones, suitable high temperature fire protection controls are incorporated to shut off the fans in case of fire.

A general schematic piping and control diagram for the entire system is shown in Fig. 2.

90 Percent Capacity Control

The 150 ton refrigeration compressor is based on cooling a maximum of 360 gpm of water from 55 F to 45 F. This unit has automatic capacity control from 100 percent to 10 percent of capacity and reduces power consumption almost directly in proportion to load. It is equipped with a purge system, so that air may be removed periodically from the refrigerant in the condenser.

Automatic controls include standard operating and safety controls. Capacity is controlled by varying the position of inlet vanes ahead of both impellers, thereby controlling the flow of refrigerant gas into the compressor. The position of these vanes is controlled through a vane operator from a simple proportional type pneumatic temperature control in the leaving chilled water line. This means that capacity is adjusted to maintain 45 F leaving water.

However, in addition to this control, there is a remote bulb temperature controller in the cold water supply line from the chiller. This controller operates a three-way modulating valve in the cold water return line from the plant. Should the compressor be operating at full capacity, and the leaving chilled water temperature exceed 45 F, this valve begins to bypass chilled water around the plant cooling units. Thus, on a hot day, if the compressor is unable to supply both the offices and the plant areas simultaneously, the offices will receive preference on the amount of chilled water available.

Condenser water is cooled in a cooling tower mounted on the roof of the building. It is a mechanical draft unit and is enclosed in steel with redwood filling. It handles 320 gpm of water with an inlet temperature of 95 F and an outlet temperature of 85 F at an ambient wet bulb temperature of 78 F.

The system was installed by the Page Air Conditioning Co., Inc.

Heat and Cool the Shopping Center

. . . with well-planned heating and air conditioning

By R. J. Abramson
Consulting Engineer,
R. J. Abramson & Assoc.

The author has previously discussed overall engineering, water supply and conservation, and heating and air conditioning for shopping centers, in the April, June, July, and October 1954 HPAC's. In this final article, he reviews the effect of insulation and the choice of systems.

THE LOCAL SHOPPING CENTER may be heated by forced air furnaces or by a boiler plant. Air conditioning may be provided by tenant installed air conditioning package units or by central systems. For the large shopping centers, a fan-furnace-evaporator coil, which is job built and which uses the equivalent of the "face and bypass" method or the "hot and cold deck" trunk method duct, may be used. Where each zone is taken off, a set of modulating dampers is installed, and a single distribution duct is continued to the zone area. The modulating dampers are usually controlled by a modulating space thermostat.

An additional advantage of the hot and cold deck system is that small areas — marking rooms, individual offices, credit offices, etc. — can have individually selected temperatures. A cable operated "V" damper with a flush mounted wall knob permits each occupant to select the preferred space temperature.

Main entrance "door blasts" are installed as a separate zone from the hot and cold deck with a set of modulating dampers controlled by a thermostat in the draft area.

Roof deck insulation, with the proper selection of materials, will give a *U* factor of 0.15 to 0.10. If "relief" grilles are placed in the ceiling to provide a humidity transfer path as well as air circulation, possibility of condensation occurring on the exterior duct surfaces is reduced. An acceptable practical ratio of net grille area to floor area is 1 sq in. of grille for each square foot of gross store area. For each bay, one-half the total grille area may be installed in the rear ceiling, and the other half may be installed in the front ceiling.

With this construction method, uninsulated ducts can be safely installed in the attic space formed between the roof and the ceiling. Field checks of attic dry bulb temperatures indicate an average difference of 6 to 8 deg between the sales area and the attic. The designer should take this sensible heat gain into account when sizing the equipment.

By proper design of the system, complete control of multiple zone temperatures, first cost and maintenance can be greatly reduced. Thus, initial cost to the owner and/or the tenant is reduced.

The selection of system types is governed largely by local codes. Some city codes require that all systems operating with over 500 lb of "Freon-12" gas have no direct expansion evaporator coils in public areas or in ducts supplying public areas. Such code requirements make a chilled water system mandatory.

The choice between reciprocating and centrifugal compressors is one of capacity and location. A central plant system over 100 tons might well be a centrifugal compressor; below 100 tons it might well be reciprocating.

The science of air conditioning has progressed to the point where relatively trouble free, completely automatic installations are commonplace. Therefore, in some communities multiple compressors, each with a completely separate refrigeration system, are designed.

The choice of a heating system is based on the type of structure considered for multiple story and/or multiple area buildings and if heated by a central plant would require a steam or hot water system for proper heat distribution and control for the several areas. The choice between steam and hot water is often judged on the space available, temperature control and flexibility. Water as a heating medium is flexible and is readily controlled to close tolerances.

Furnace systems find their largest application in small and medium one floor areas.

In the small retail shop, an absolute minimum of attention is usually given to the heating and cooling installation. Generally, the proprietor will shut the system down over the week-end to save fuel and electric operating costs. Therefore, this type of system is subjected to frequent thermal shock; the heating unit should be selected with this point in mind.

The local shopping center is a diverse group of small retail stores in one common location. Common leasing practice is to have the tenant pay for utilities, air conditioning equipment, and special equipment required for his merchandise sales. The landlord furnishes sanitary facilities, electrical facilities, and a heating system designed for the tenant's air conditioning equipment.

The individual requirements for storm water, sanitary sewer, process and potable, cold city water, gas, and electricity are integrated into a common system for the shopping center as a whole.

Finally, all engineering questions are balanced against the policy of "acceptable tenant space condition for average life at the minimum initial first cost to owner."

Improving the Combustion

By Kalman Steiner
C. Hoffberger Co.

• Smokeless, efficient burning of heavy fuel oil depends on knowledge of several things: the oil viscosities and the necessary preheat temperatures involved; firebox design; boiler ratings; and the latest revised smoke control ordinances. A previous article on this subject by the author appeared in the August HPAC.

• *draft control must minimize draft loss*

AT NORMAL RATES of heat release — 25,000 to 50,000 Btu per cu ft per hr — there is little need for mechanical draft, except to avoid erection of a tall stack.

In most package boilers mechanical draft is needed for two reasons: the high rate of heat release, and the high resistance of the small diameter tubes. The chief function of draft is to overcome resistance. The resistance to flow is known as the draft loss through the boiler. In the average fire tube boiler with 3 in. diameter tubes, this loss seldom exceeds 0.5 in. water gage.

The purpose of the draft controller is to allow just enough draft to overcome flow resistance. Greater draft causes excess air flow and reduces combustion efficiency.

Draft controllers vary in complexity from the familiar barometric type to the metering combustion controller that includes individual power units to independently position the uptake damper, inlet damper, and fuel feed valve.

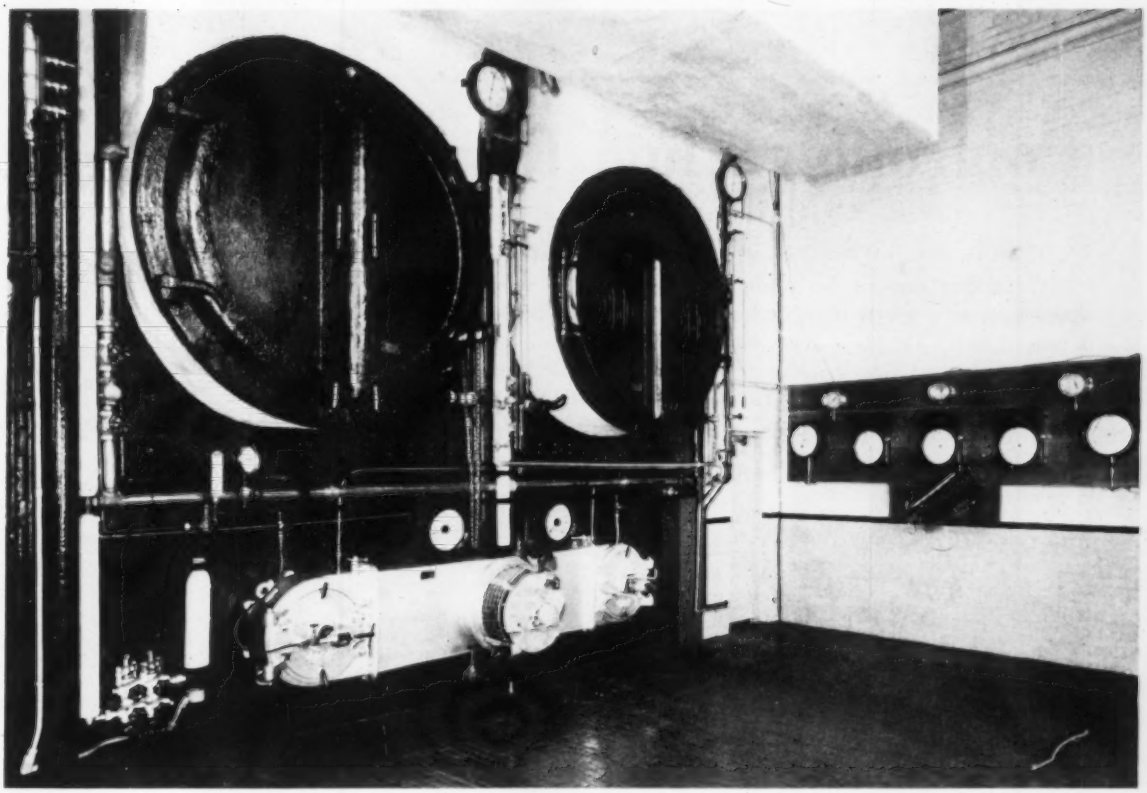
In my experience, burners up to 70 gal per hr input capacity, on conventional boilers, with secondary air ports in the floor of the hearth, with natural draft, operate satisfactorily with a barometric draft controller for regulating overfire draft and a modulating motor to position the fuel valve and secondary air damper in accordance with load demand. If the secondary air is introduced in a peripheral slot and the doghouse does not have a duct containing a damper, the modulating motor can be linked to the uptake damper.

The most usual form of motorized overfire controller consists essentially of a diaphragm fastened and housed in such a way that a change in overfire draft causes movement of the diaphragm to be translated into motion by a power unit linked to the uptake damper. The power unit, of course, is reversible in direction.

In the typical sequence program, the power unit closes the uptake damper when the burner stops, thereby minimizing air flow through the boiler setting during the "off" period. When the control system again calls for burner operation, the power unit first swings the damper wide open, thereby permitting the system to start the burner. The burner then has maximum draft to handle the first surge of gases into the firebox. As soon as the burner is running normally, after some 30 seconds of operation, the power unit resumes modulation of the damper in accordance with overfire draft.

In the metering system, the difference in draft between firebox and uptake is varied with load demand so as to establish greater pressure difference with an increase of the volume of combustion gas.

Efficiency of Heavy Fuel Oils



CLEANLINESS is a cardinal principle in the burning of heavy fuel oils. Nozzles, atomizers, strainers, boiler tubes, and flues should all be cleaned regularly. Neglect of equipment shows up in untidy appearance and high fuel consumption

• *smoke control codes contain curious clauses*

WHILE many smoke abatement rules and regulations of municipal and similar air pollution control authorities contain clauses as to heat release rates — with an average of 35,000 cu ft per hr — many codes contain no stipulation as to combustion volume. Some set up hearth area as a basis of design, requiring a minimum floor area depending on firing rate, from 65 to 100 sq ft per U. S. gal burned per hr. Codes with such a clause usually require also that at least 75 percent of the total combustion volume be in front of the bridge wall in all installations.

There are some curious clauses in some of the ordinances. Some set the maximum ratings to which boilers may be fired, attempting to resolve by legislation or edict what engineers have been unable to do by technology. Some allow higher heat release in power boilers than in heating boilers; some codes have the reverse.

Other codes rule that No. 5 shall be the heaviest fuel oil burned under low pressure boilers.

Many codes call for an automatic smoke alarm. This is wishful thinking. A properly installed burner won't cause smoke. And a smoke alarm won't cure a poor installation. If on rare occasions an alarm sounds during operation of a proper installation, it may ring an entire weekend when there may be no one around.

Some ordinances attempt to define "package boilers" and "boiler-burner units" as being different. Others require an Underwriters label if boiler and burner enter simultaneously.

Abstracted from a paper presented at the recent annual meeting of the Air Pollution Control Association.

By Bill Dopp

Controlling Fluid Flow with Valves

. . . is the second fundamental of piping design," says Mac. "Without that control, we would still be carrying water in sheepskins or earthen pots, and civilization would be where it was in early Egypt." Starting with the invention of the plug cock by the Greeks, Mac traces here the development and application of valves. Discussed are the lift check, angle, gate, globe, swing check, pop, and relief valves.

"How are you getting along with that thesis on 'High Pressure, High Temperature Piping?' " asked Martin MacVane. Dave Hawley, with his friend Jim Drury, had just been welcomed into Mac's office.

"Well, it's mostly notes, so far," replied Dave. "I've been trying to apply some of the principles that you laid down on our last visit, and I'm amazed at what I've gotten into. Sometimes, when I look over the pages of accumulated figuring for various pipe thicknesses for different materials and different pressures and temperatures, I get dizzy," he laughed disparagingly.

"I get a kick out of watching him scowl at that slide rule of his," remarked Jim with a chuckle.

"You'll make it, all right, Dave," said Mac cheerfully. "What's on your minds now?"

"You promised to discuss the second fundamental of piping design," Dave reminded him. "You said that after the first fundamental — the selection of material for the line — that control comes next."

"That's right, Dave," answered Mac thoughtfully. "I sometimes wonder, though, whether control isn't more important."

Mac pondered a moment. "You've been told many times, no doubt, that man took the most important step in civilization when he discovered how to make fire. I'm inclined to think it was when he gained control of the flow of fluids that he found the real key to his mastery of nature. Without that control, we would still be carrying water in sheepskins or earthen pots, and civilization would be where it was in the early days of Egypt."

Mac continued, "The Syrians and the Egyptians had used piping of one kind or another to convey water for hundreds of years, but they had no way of stopping or regulating the flow except to plug up the pipe. The Greeks, however, about the fifth century B. C. invented the plug cock. With this they were able to stop the flow, and they could also regulate the amount of water passed through their lead piping."

"Gee! Wait till I spring that one in history class," declared Jim.

"The idea is completely new to me, too," said Dave. "When I think of how they handle water on my grandfather's farm, I can see what you mean." He grinned at Mac. "Seems that the Greeks started a lot of things."

"Yes, Dave, the Greeks did start a lot of things. But it is the improvements that have been made on what they started that really count. You see, it was nearly 2000 years later before anyone else thought up another valve."

"Do you mean that the plug cock was the only means of controlling flow for 20 centuries?" demanded Jim.

Da Vinci Invents Check Valve

"Yes, Jim," replied Mac. "In about 1500 A. D. Leonardo da Vinci turned a Roman plug cock into a lift check valve. He took the solid plug and put a stem at both the top and the bottom. The stem guided the disc into a conical seat in an enlarged section of a vertical pipe. That was our first check valve. It was a tremendous step in the controlling of water in a pipe. Da Vinci used it with his single acting pumps to prevent the water from flowing back into the cylinder when the piston made the return stroke. He lifted water several hundred feet with it."

"What was the next step?" asked Dave.

"Let's remember that the word *valve* is the Latin word for *door*," said Mac. "The Romans had used the screw jack for centuries, but it took a Frenchman — about 100 years after the invention of the check valve — to design a new kind of door in a pipe line. He combined the plug of the cock and the screw jack

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Bill Dopp has had some 40 years of experience dealing with piping, including a long stretch as a sales engineer. He is devoting part of his present leisure to writing of his many piping experiences. All the names used are fictitious.

into what we know as the angle valve. From this, the globe valve was later developed."

"When did the gate appear?" asked Jim eagerly.

"About another 100 years later, another Frenchman substituted a flat plate in a valve body for the plug type disc of the globe valve." Mac chuckled to himself. "Keep in mind that the first globe valve was a plug type valve."

"Then there are four original types of valves," said Dave thoughtfully.

"How about the swing check?" demanded Jim quickly.

"That is a distinct type of valve, Jim," agreed Mac, "but since it performs the same function as the lift check, in classifying valves we generally group them as one type. There is a reason for the difference in construction, though. We'll discuss that later."

Each Valve Has Its Own Job

"Which is the most important valve?" asked Dave.

"There is no most important valve, Dave," said Mac. "Each type has its own particular job. No other valve can do that job as well."

"Does that mean that at any given place in the line there is just one right valve to use? Don't some valves perform more than one function?" contended Dave.

"The answer is 'yes' to both your questions, Dave," asserted Mac. "There is always one right valve to use, but there are cases where a globe valve, for instance, will be used as both a control valve and a stop valve. Let's take the valves in turn and see what they really should do."

How the Gate Valve Works

"Okay," consented Dave. "Suppose we start with the gate valve."

"All right. What is a gate valve?" Mac eyed Jim shrewdly.

"It's a sliding door in a pipe line," replied the grinning boy.

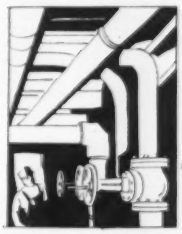
"Right the first time," declared Mac smiling. "The disc of a gate valve slides across the opening in the line to close it completely or to open it entirely. Dave, what do you call a valve when it's only partly open?"

"It's in a throttling position," answered Dave.

"And a gate valve should never be used that way," interjected Jim.

"That's right, Jim. The purpose of the gate is simply that of stopping the flow of fluid in the line. It should never be used for any other purpose, except in an emergency. Now where should this valve be used in the line?"

Dave answered quickly. "Wherever a branch line leaves a header or a manifold. It can be used at the end of a line, too, where you expect the flow to be the full capacity of the line."



"Don't you think that it might have a proper place as an emergency valve in a main line, too, Dave?" inquired Mac.

"Sure," admitted Dave. "That's where you would use a power operator to close the valve quickly. The oil companies use big gate valves that can close in a few seconds."

"You might use a valve like that in a vapor or gas line," interrupted Jim. "You couldn't use it in a liquid line, if the fluid was moving with any speed."

"Why not?" asked Mac turning to Jim.

"Water hammer might wreck the valve. They say never put a gate valve at the lower end of a penstock because the velocity head might set up a terrific shock, even when the valve is closed slowly. They build a special valve for that purpose. I've heard it called a watermelon valve," he declared, grinning.

"Yes, Jim," affirmed Mac, "that's really a special type of controlled check valve. The point is, don't you see, that you can't generalize. Each problem of control has to be given individual attention, and where a common type of valve will not serve, a special type has to be constructed."

"Speaking broadly, then," commented Dave, "where the problem is to stop the flow entirely, good engineering dictates the use of a gate valve."

"That's true, Dave," asserted Mac. "There are exceptions, of course, as with the penstock valve, but that rule should be followed, unless you have special conditions."

Use Plug Cock for Cold Fluids

"Hold on a minute!" exclaimed Jim. "We've forgotten the plug cock, the daddy valve of them all. How about that?"

Mac laughed. "Good question, Jim. How about it, Dave?"

"Gosh! That's used to stop the flow completely, too. What *is* the difference Mr. MacVane?"

"Temperature is the main difference," declared Mac. "That valve is mainly used for cold water or cold fluids because heat tends either to make it leak or to freeze it so badly that you can't turn it. Sometimes, where there is some advantage in using a plug cock because of the time element in opening and closing the valve, a special mechanism is used to lift the plug before trying to turn it. There are special lubricated cocks that serve very well on moderately hot fluids, but they require constant attention to prevent their sticking."

Mac raised his eyebrows as a thought struck him. "By the way, there's a plug cock, sometimes known as a cone valve, that has proven quite successful as a penstock valve, Jim. Some of them are pretty big."

Dave was busy making some notes. Looking up, he said, "Plug cocks would be used generally on small lines for cold service."

"Or for gas," interjected Jim.

"That's right," added Dave. He straightened up abruptly. "Holy smoke!" he exclaimed. "This thing is getting more complicated than the selection of material."

Jim laughed, "You still have to select the material for your valves, Dave," he chided his friend. "We haven't come anywhere near your high pressure, high temperature steam line yet."

". . . There is always one right valve to use . . . . There is no most important valve; each has its particular job."

Mac went to his bookcase. Returning, he laid a large volume on the table. "This is the general catalog of a leading manufacturer of valves and fittings for piping. A vast amount of experience and research has gone into its making. It will provide the answer to many questions on flow control."

Globe, Angle Say "How Much"

He opened the book. "Take globe valves, for instance. Here they are, for almost any kind of service that you can name."

"You said to remember that the original globe valve was a plug type valve," Jim reminded Mac. "Why?"

"For many years, there were practically no plug type globe valves on the market. A lot of different designs were tried, serving fairly well for a long time, but they all, sooner or later, came to grief. This was especially true where close throttling was involved or where exceedingly high velocities were encountered."

Mac paused. "It's the short plug type disc that has finally solved most of the ordinary problems and many of the special ones, too. Today, nearly all of the globe valves for severe service are of this type.

"And its purpose is to control the flow of fluids," said Dave.

"The primary purpose of the globe valve and its companion, the angle valve, is to provide the 'how much' in any pipe line," said Mac. "Regulating the quantity of a fluid through a line is one of the most important functions in modern industrial production. Without valves that can do this task precisely and continuously, our great production lines would be impossible. Not only water, but every kind of fluid for every purpose, must be kept under constant control while being transported from one place to another. Once control is lost, any kind of disaster can result."

"That, then, is the precious key to the mastery of nature that you spoke of?" mused Dave thoughtfully. "Where would we be without globe valves?" he observed.

"Not very far along the road of progress," said Mac. "It was probably an attempt to control steam for one of the early types of steam engines that led to the invention of the globe valve in the 17th century. It was about that time that people were experimenting with the idea of putting steam to work. They had to find a way to control the steam to the engine to start and stop it."

Don't Throttle with Gate Valve

Turning to Mac, Dave asked, "You never did explain why a gate valve should not be used for throttling. Is there some special reason?"

"Yes, Dave, there are several good reasons for that prohibition." He opened the catalog, pointing to the cross section of a wedge gate. "If that disc is hanging in the stream passing through the pipe, it may begin to vibrate. The disc is only loosely guided and usually has no rigid connection with the stem. Once it gets to vibrating, the impulses will be transmitted to the line. The valve, in addition to trying to beat itself to pieces, will ultimately affect the pipe line joints. In high pressure, high temperature work it can even seriously affect the welded joints."

"Aren't there several kinds of discs used for gate valves, too?" asked Jim.

"Yes. There is, of course, the wedge disc, perhaps the most universally used. Then there is the double disc, the split wedge and such special discs as the flexible disc for high temperatures and the flat plate disc of the paper stock valve. Each has its purpose and will give good service if properly used."

"I've heard a lot of argument about the double disc valve," remarked Dave. "Some say they are no good, and others swear by them. What is the real lowdown on those valves?"

"That's been argued since Hector was a pup," laughed Mac. "It's a question that's likely never to be settled. The double disc valve has some distinct advantages in large water lines and in gas lines that are buried where the line is likely to change its position, putting severe strains on the valve bodies. The two parts of the disc can adjust themselves to minor changes in the body, assuring a tight valve where a wedge disc valve would probably leak!"

"How about using them on steam lines?" asked Jim, chuckling softly.

Mac shook his head. "No, Jim. Even when the valves are wide open, the two loose disc parts frequently get to vibrating because of the higher velocity of steam. This can wear the valve out without any work being done. You also have to watch out for the way these valves are placed. If they are put into the line with the stem down, they may lock open so that they will have to be taken apart before they can be used to stop the flow in the line."

"Is there anything to the story that these valves are more likely to blow up than any other valve?" asked Dave.

"There's enough to that story that they frequently put relief valves on the bonnet of double disc valves."

Dave said, "a relief valve is really an automatic globe valve, isn't it?"

Pop Valve Differs from Relief

"It's more likely to be an automatic angle valve, since the angle lends itself more readily to relief arrangements. Really, any relief or pop valve is a spring or weight loaded check valve. It's the pressure under the disc that opens it and the spring or weight closes the valve

when the pressure has been relieved. Do you know the difference between a pop valve and a relief valve?"

"The pop valve opens, blows and closes with a snap, but the relief valve usually just opens and closes gradually," answered Dave cautiously.

"That's right," agreed Mac. "But what makes these valves act differently?"

"It has something to do with the design of the disc," suggested Jim.

"In a pop valve," began Mac, "the disc is so shaped that a relatively small area is exposed to the internal pressure when the valve is closed. As the pressure gets high enough to overcome the force of the spring and lift the disc, that pressure suddenly spreads over a much larger area due to the presence of a regulating ring surrounding the larger diameter of the disc. That forces the disc to rise higher than it would with the smaller disc. The pop chamber that it created can be made larger or smaller by raising or lowering the regulating ring. This determines the blowdown or the time that the valve will remain open. When enough pressure has been dissipated, the disc will reseat with a snap." Mac turned to the catalog again. "You can see that some relief valves also have regulating rings. That makes them act in many respects like a pop valve, although the change in the disc area is never as great as in a pop valve."

Check Valve Prevents Backflow

"These valves, then, really control the pressure inside the boiler or any vessel to which they are applied," observed Dave.

"Yes, Dave, these valves are an absolutely necessary control of internal pressures. When load suddenly goes off a big turbine and 25 or more of these pop safety valves open up in the middle of the night, everyone for miles around knows how valuable they are," he chuckled. "They make a frightening noise."

"All check valves are automatic valves, aren't they?" asked Jim.

"Right, Jim," agreed Mac. "The check valve, of course, prevents the fluid from flowing backwards in the pipe. They have been made with many kinds of discs and all sorts of devices to reduce friction and insure quick closing."

"Why the quick closing?" Dave demanded.

"In a water line, if the flow stops suddenly because the high side pressure has fallen rapidly, the fluid will tend to reverse its flow at once. When the disc of a swing check valve is in a fully open position, that reversal may occur before the disc has dropped to its seat. If that happens, the flow will tend to accelerate the movement of the disc, causing it to slam against the seat. It may even cause a severe water hammer in the line."

"So good-by seat," laughed Jim.

"Could be worse than that," commented Dave. "Might cause the breaking of a joint. Isn't that so, Mr. MacVane?"

"Yes, Dave," replied Mac. "Slamming check valves can do a lot of damage to the lines. They can also cause leakage in the valve that may do damage to the pump by forcing it into reverse. You see, again, that it is not only control that you need but positive control."

"You have to be sure at all times exactly what the fluid in the line is doing," Dave reflected thoughtfully. "I'm beginning to have profound respect for valves."

"Queer things happen inside valves, sometimes," declared Mac. "For a long time, valve makers were puzzled by the high pressure drop in lines having lift check valves. After a lot of research, it was discovered that the cause of the trouble was the way the disc was guided from above by a piston in a sleeve. Pressure would work up on top of the piston, forcing it down. The static pressure in the confined space was a bit higher than the pressure of the flowing fluid. The valve would hunt until it found a balanced position, leaving it almost closed with full pressure in the line."

"How did they remedy that?" Jim asked.

"By providing relief of the static pressure to the low side of the valve. Most stop-checks are equipped with outside relief pipes for this purpose."

"Another automatic valve!" snapped Dave.

"Just a check with a loose stem to lock it closed," retorted Jim.

"Both right," chuckled Mac. "Now what are you going to do with that steam line of yours, Dave?"

"I'd almost forgotten that. I suppose the fundamentals of control will apply to that, too."

"I can see where we have left out a lot of things on this control fundamental," declared Jim ruefully. "Take pressure drop, for instance. That's important in valves, too."

"Yes, Jim," replied Mac, "pressure drop is very important in valves. Again, it depends upon what you are trying to do with your fluid. In a straight line a globe will have about 50 times as much resistance to flow as a gate valve. But if you want to reduce the flow, you will want to avail yourself of a great deal of pressure drop by adjusting that globe valve. Likewise, if pressure drop is important to you, use a swing check valve."

"Then it's always a matter of why and how you want to control a fluid in a pipe line," observed Dave. "I can see where every line has to be studied by itself if the proper control is to be provided."

"No wonder a valve catalog is such a big book," declared Jim, picking up the volume. "If you knew all about what's in this book, you'd really understand control."

"You're right, Jim," said Mac, "but keep in mind that the last word on the subject has not been said, by any means."

Dave glanced at his watch as he got up to go. "Last time, you said there was no such thing as a simple pipe line. I'm convinced."

As Dave extended his hand, he said, "We'll be back next week."

THE LAW AND YOUR PROFITS

By William Hurd Hillyer

"Claim Right Sum at Right Time"

. . . say works-payment statutes to contractors doing business with some states or other public entities

CONTRACTORS, subcontractors, and material suppliers enter a legal wilderness when they do business with states or other public entities. Many relationships are governed by statutes of local application rather than by common law principles.

Among such statutes are those designed to assure payment for labor performed and for materials used by, or furnished to, contractors or subcontractors engaged on "public works."

Familiarity with the exact wording and true intent of works-payment statutes in subject areas is therefore of great importance to heating, piping and air conditioning contractors and their suppliers. A recent piping job is a case in point.

Hoosit Bros., general contractors, made an agreement with the state covering the installation of certain piping. [All names are fictitious.] Fulfilling legal requirements, Hoosit posted a $188,000 surety bond "for the use and benefit of all persons, firms and corporations who may furnish any material." Hoosit ordered from Hypresha Pipe Co. some 10,000 linear feet of the pipe specified in the contract.

The agreement between Hoosit and Hypresha contained this provision: "The terms are net the 15th of each month for all pipe and fittings shipped the previous month." Discount provision was lacking.

Contractor Fails to Pay

For much of the materials used in the piping installation, Hoosit, for undisclosed reasons, failed to pay. The superior court ordered the state and the contractor's surety to remit the balance due on the contract. The surety company, to which Hoosit had assigned its contract, appealed to the supreme court. That body saw the case hinging upon one question: Did the Hypresha Pipe Co. *seasonably* file "a sworn statement of its claim as required by statute"?

In order to obtain the benefit of bond security, as the higher court construed the law, the claimant — in this case the pipe company — must file with the proper state officials a sworn statement of claim within 60 days after ceasing "to perform labor or furnish labor, materials . . ."

As reviewed by the higher tribunal, the schedule of deliveries, payments, and claims was drawn out over a period of more than eight months. The contract price of all pipe, fittings, and materials furnished, less freight, was $71,792, of which Hoosit paid $38,591 and left unpaid $33,200.

Eight months after work was begun, the last work was done. Two days later Hypresha shipped five gaskets and 1 lb of oil soap, price $11.44. The next month that company filed a claim for $43.64, covering wages and expense of truck delivery on pipe five months previously. These small items are mentioned to show the complex and desultory manner in which the transactions were handled.

Surety Company Denies Claim

The surety company contended in court that the agreement between Hypresha and Hoosit was an *entire* contract, and that all the sworn statements of claim filed by the pipe concern were worthless because they were filed either too early or too late. Furthermore, according to the surety company's view, the statutory security could not be claimed for pipe and materials furnished by Hypresha under any statement of claim filed *before* the contractor actually *incorporated them in the installation.*

The surety people also suggested that no statement of claim could be filed before the date specified for payment, namely "the 15th of the month for all pipe and fittings shipped the previous month."

Hypresha, on the other hand, insisted that the contract was *divisible* and that the successive sworn statements were valid as covering successive periods of delivery and installation. The piping company endeavored to show that it had filed a statement of claim within 60 days after each shipment and within 60 days after furnishing the last materials installed on the job.

[Note: While this discussion applies to an actual case, it should be remembered that legal rules vary in different states.]

WILLIAM HURD HILLYER, author of this regular feature, is a contributor to a number of banking and financial publications and has written several books on business. A former vice president of the Atlanta Trust Co., his work there gave him a practical legal background.

The court sustained the lower court's rejection of the "entire" theory and of the surety company's position in general but amended the judgment. The supreme court thought the statutory security might be enforced "for the proportion which the number of linear feet of pipe installed bears to the number delivered."

As it happened, the claimant in this case was a pipe manufacturer against a surety company acting for a general contractor. Under different circumstances, it might well have been the heating, piping or air conditioning contractor who sought his money. The legal principles involved would have been the same.

The claimant, because he is dealing with a state government, is confronted with delicately poised statutory requirements regarding filing. By their very nature, such requirements call for the strictest enforcement. To file for the right sum at the right moment — neither too early nor too late, and for a sum neither too much nor too little — is like balancing on a tightrope.

QUESTION OF THE MONTH

What Causes Book Pages to Crinkle?

THE QUESTION, *What Causes Book Pages to Crinkle?*, was published previously in HPAC and is repeated here for information along with an answer to the question that has been received. Other comments for publication will also be welcome.

"A bookstore in Montana with a 250,000 volume stock of used books suffers considerable loss from warping and crinkling of the paper pages. It is not practical, however, to install air conditioning, or even to provide a well insulated, heated building since the books are mostly low priced. The damage occurs during severe cold spells.

"The building, on a well drained site, is partly floored with concrete. Part has dirt floor topped with gravel, then concrete blocks. Over the blocks is a platform on which book stacks stand. Part of the building has a double ceiling and part has side walls which are provided with double sheathing and two layers of tarred felt and an exterior of aluminum sheet metal.

"Books moved to the heated office during cold speels quickly warp unless humidity is kept up, but in distant unheated parts of the building, cold alone seems to warp and buckle the paper. Is this caused by the small amounts of moisture traveling in and out of the paper? Extreme cold has the same effect as extreme heat. Both cause rapid dehydration and consequent wrinkling. On the other hand, vapor pressure decreases with the temperature. But does not vapor pressure cause moisture migration? Yet books placed in the owner's deep freeze don't seem to buckle at zero F. Is it the lack of moisture and/or moisture movement due to temperature extremes? Ventilation or the lack of it does not seem to help. Will cold alone do real damage, or are there unrecognized factors present?" —D.L.

AN ANSWER

L. V. TEESDALE —

"Slow Change in Humidity Should Not Damage Books"

THIS PROBLEM is not uncommon. Many librarians have encountered the same trouble, in varying degrees, in attempting to properly store books and documents.

The dimensional changes that occur in paper products with normal changes in humidity are probably unimportant. Rapid changes through a wide range in humidity could cause unequal expansion or contraction, particularly in assemblies of sheets of papers as in books. In such cases, the exposed edges would change moisture content rapidly but the interior portion of the book would change slowly. Differences in moisture content between the edges and center would cause crinkling and buckling of the pages.

Different types of paper vary in their susceptibility to shrink and swell with changes in relative humidity. For example, the percentage of elongation of a typical book paper is less than that of a 60 lb kraft paper when both are brought from a moisture-free atmosphere and exposed to different relative humidities. (See Table 1.) This might account for differences in the amount of deformation found in different books subjected to the same exposure.

Grain direction applies to the length of the sheet when the paper is made. Elongation across the grain is greater than in the grain direction. The deformation is not a straight line relationship but is greater be-

TABLE 1—ELONGATION of a typical bookpaper and a 60 lb kraft paper when moved from a moisture-free atmosphere and exposed to different relative humidities is shown here

Material	Relative Humidity, percent				
Book paper	20	40	60	80	100
Cross grain	0.19	0.34	0.53	0.72	1.20
Grain direction	0.11	0.19	0.27	0.34	0.50
Kraft wrapping					
Cross grain	0.32	0.53	0.78	1.18	1.68
Grain direction	0.18	0.28	0.38	0.51	0.84

tween zero and 20 percent and between 80 and 100 percent than in the middle of the range.

If exposed to a constant relative humidity, hygroscopic material will in time adjust its moisture content until it reaches a state of balance, usually referred to as the equilibrium moisture content, or EMC.

Books stored in a space where the relative humidity is controlled should attain a fixed moisture content in equilibrium with the humidity conditions. There would be no dimensional change. For books stored where the relative humidity varies slowly between 20 percent and 70 percent, there would be minor dimensional changes; but they would probably be unimportant. Rapid changes in humidity through the same range would probably produce dimensional changes that would be apparent, through probably not destructive. A rapid change in humidity from 50 percent to 90 percent would probably be more harmful than one from 20 percent to 70 percent because the change in moisture content would be greater.

Obviously, there should be no deformation in books stored in a space where the temperature and humidity are constant. In fact, it appears that books may be stored under conditions where rather wide ranges in humidity occur — such as those between summer and winter — without showing evident deformation. In other words, if changes in humidity take place slowly, the books may go through a wide range without damage.

Temperature would not be a factor except as it affected humidity. The crinkling and buckling of the book paper indicates that the books are stored under conditions where the humidity changes rapidly and through a comparatively wide range. Since it has been observed that the damage appears during or after cold weather, it could be the result of a cold snap following a period of warm weather. During a period of warm winter weather, the humidity in the storage building could be high. As outdoor temperatures drop, the humidity within the building will also drop.

"How Much Does Air Conditioning Help Business?"

"What actual percentage increase in business can be expected in a store, a restaurant, and a hotel dining room, as a result of the installation of air conditioning? I would like to obtain specific data from actual installations."—A.B.

• *YOU ARE INVITED to contribute a question for publication, or an answer to a published question. Please address your reply to the Editors, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.*

When books in good condition were unpacked in a heated room and moved into a room where the temperature was below freezing, the edges of the leaves in the books became curly in a matter of hours. Thus, books exposed to a sudden change in humidity will show evidence of deformation. In this case, the exposed edges picked up moisture and swelled, while the inner portion of the leaves had not picked up moisture fast enough to equal the swelling of the edges. Consequently the edges had to curl. Wetting the edges, but not the center, of a dry sheet of paper would produce a similar curling.

If our theory is correct, it would appear that the buckling of the center of the sheet is caused by exposure of the book to a rapid variation in humidity, presumably from an exposure of relatively low to a very high humidity.

Wide fluctuations in humidity can develop in an unheated building in a climate where outside temperatures are subject to sudden and wide variations. If the temperature within the storage shed was maintained at 15 F or more above the outside temperature, the humidity inside would always be relatively low and wide fluctuations could not occur. When outdoor temperatures are above 60 F, no heat would be required, unless outside conditions were overly humid.

It should not require much fuel to heat the storage rooms as suggested. However, the roof would be improved materially insofar as heat loss is concerned if the underside of the joists could be covered with ¾ in. fiberboard.

While it would perhaps help the insulation of the side walls to place book shelves along the walls, it could be bad practice. The temperature at the wall would be lowered because of the books, and this in turn would raise the humidity, leading to trouble.

The construction of the building is low in resistance to heat loss, and with a sharp drop in outside temperatures wall and roof temperatures would be cold. Moisture condensing on such surfaces would lower the vapor pressure in the storage space. If the space were not heated, the temperature of the space would also drop. The books and other contents, being warmer than the atmosphere, would give off both heat and moisture. Loss of moisture from the edges or exposed surfaces of the book paper faster than from the inside of the book sets up the conditions that cause crinkling and buckling. With the return of mild weather, the crinkling should disappear.

Conditions favorable for crinkling and buckling might also occur during the early summer if there was a rapid increase in outside temperature with comparatively high humidities after a long period of relatively cold weather. The atmosphere within the building might be 20 F or more below outside temperatures, and the humidity inside could be very high. The atmosphere inside might be compared to a basement in the late spring or earlier summer — damp and cool. Moisture absorbed into the exposed surfaces of the books could be responsible for crinkling and buckling.

Corrective measures would involve storage of the books under conditions where the relative humidity could be controlled so as to prevent rapid changes in atmospheric conditions. Slow changes, even through a comparatively wide range in humidity, should not create a problem.—L. V. TEESDALE, ENGINEER, Div. of Physics and Engineering, Forest Products Laboratory, Forest Service, U. S. Dept. of Agriculture.

ON THE JOB

Heat Pump Aids Hog Farrowing

. . . production increase reported

DUCT SYSTEM of heat pump system is shown in the farrowing barn of Conner Prairie Farms, Indianapolis. The unit heats, cools, dehumidifies and ventilates depending upon the condition desired

A HEAT PUMP that heats, cools, dehumidifies and ventilates a building from one compact unit has been applied with considerable savings to the farrowing of hogs on the Conner Prairie Farms near Indianapolis, reports the Westinghouse Electric Corp. This is one of the first installations of its kind and is considered a prototype of its application to other animal husbandry requirements.

Tillman Bubenzer, manager of the farms, reports greatly increased swine production, lower initial investment and operating costs.

The heat pump controls the farrowing barn temperature regardless of the outside weather. In this way, multiple farrowing can be planned and conducted year around instead of seasonally, and valuable barn space is utilized to the utmost.

"We are still in the process," Mr. Bubenzer said, "of collecting swine production data as a result of using this heat pump. Although our overall production has increased since it was installed, we particularly observe a decrease in swine fatalities during that crucial two weeks period after birth."

The heat pump is installed in the loft of the farrowing barn, where it occupies no more space than an average size furnace. The unit is fully automatic, and does not have to be adjusted as outside temperatures change. It maintains a minimum temperature of 65 F in the winter and 72 F in the summer.

The heat pump was installed by the Illingsworth Construction and Engineering Co., of Indianapolis.

Window Units Cool Wichita City Hall

. . . central system on top floor

INDIVIDUAL window units were chosen to air condition the first three floors of Wichita's 60 year old city hall, according to the O. A. Sutton Corp. Huge thick walls of stone support the four story structure. With similar thick heavy stone walls inside to separate various sections, the building did not lend itself to a central system. However, a central system is installed for the fourth floor since necessary ductwork could be run through attic areas. The window units, ranging from ½ hp to 1½ hp, were designed to operate on 208 volts due to the building's power facilities.

Said the city purchasing agent: "When we planned for the individual window units, we thought we would have to keep office doors closed, but that has not been necessary."

PIPE WALL THICKNESSES are accurately measured to within 0.005 in. — even at bends, which are ordinarily difficult to check — by means of an ultrasonic machine known as a reflectoscope at the power piping and sprinkler division plant of the Blaw-Knox Co., Pittsburgh. The machine is also used to detect internal flaws in the metal; such flaws cause a wave reflection on the scope

Solar Irradiation of East or West Inclined Surfaces

By F. W. Hutchinson* and M. O. Cotter**

THIS IS the second of a series of three data sheets covering the hourly and monthly irradiation of inclined surfaces.*** The first, covering south-facing inclined surfaces, appeared in the August HPAC. The third will cover southeast or southwest inclines.

The first column of each of the four tables (5b through 8b) — covering latitudes 30, 35, 40, and 45 deg — gives the months and hours of the day. It will be noted that east facing inclined walls receive direct solar irradiation from sunrise until sometime after solar noon, whereas west facing inclined walls start receiving direct irradiation at a later morning hour (depending on the angle of the wall's inclination) and continue to be directly irradiated until the sun sets.

The second column of each table gives the basic solar intensity, I_o, in Btu per hr received at that time on unit area normal to the direction of the sun's rays. The third, fourth, and fifth columns give, respectively, the angle of incidence, i, the cosine of the angle of incidence, and the $I_o \cos i$ product for a wall with 30 deg inclination backward. The product is numerically equal to the actual rate of reception of solar energy per unit area of the wall.

Note that of the energy received — the irradiation rate — part will be either transmitted (as for windows) or absorbed (as for opaque surfaces) and the remainder reflected. The effective solar gain must therefore be calculated in terms of the known surface characteristic of the receiving surface.

The sixth, seventh, and eighth give i, cos i, and $I_o \cos i$ for surfaces with 60 deg inclination, whereas the last three columns give the same information for 90 deg inclination (that is, for horizontal surfaces).

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**Consulting Engineer.

*** Irradiation of vertical walls was covered in two previous series of Data Sheets: irradiation tables for October through April appeared in the July 1949, December 1950, and May 1951 issues of HPAC; tables for May through September appeared in the September, October, and November 1954 HPAC's.

Interpolation between latitudes, angles of inclinations, and facing directions (refer to the preceding and the following data sheet for other directions of inclined walls) permits direct determination of the irradiation rate for any wall at any time in any place within latitudes 30 and 45 deg.

The tabular irradiation values are for clear days. During partially obscured or intermittent sunshine the actual rate of irradiation will be less than the tabular values. But where solar effect is being considered with respect to cooling load, the designer will be primarily interested in clear weather data.

For problems involving analysis of solar energy reception as an aid in meeting the heating load, the clear weather data is not conservative and must be adjusted by the designer in terms of experience and of weather bureau records for the locality in question. Lacking more specific information, it is suggested that the clear weather values be multiplied by the percent of maximum possible sunshine and then reduced to 60 percent of this value as an arbitrary correction for reduced normal intensity in light cloudiness.

For problems involving the sizing of equipment to meet a given heating or cooling load, the interest of the designer will be primarily directed toward instantaneous values of the irradiation rate. In performance problems, however, he will be more concerned with the quantity of solar gain rather than with the maximum rate. Total irradiation per unit area for any day equals the average rate times the number of hours that the surface is exposed to direct solar irradiation.

The actual number of hours of the day that a wall is subject to direct solar irradiation obviously depends on the month, the latitude, and some orientation of the wall. To assist in calculating solar quantities, Table 1 gives maximum possible hours of direct irradiation for *vertical* walls for different latitudes, months, and facing directions. Modifications of the data in Table 1 for use with inclined walls can be obtained by reference to the incidence angles given in the data sheets.

TABLE 1—MAXIMUM HOURS OF POSSIBLE IRRADIATION shown here for vertical walls may be modified for use with inclined walls by reference to the incidence angles given in the accompanying data sheets

	South facing				Southeast or southwest facing				East or west facing			
	30 deg	35 deg	40 deg	45 deg	30 deg	35 deg	40 deg	45 deg	30 deg	35 deg	40 deg	45 deg
December	9.7	9.7	9.2	9.2	8.0	9.1	7.8	7.8	5.0	4.9	4.6	4.6
January	10.5	10.0	9.6	9.4	8.1	8.9	7.8	7.9	5.3	5.0	4.8	4.7
February	11.3	11.1	10.7	10.8	8.0	8.0	8.2	8.0	5.7	5.6	5.4	5.4
March	12.0	12.0	12.0	12.0	7.8	7.8	8.4	8.2	6.0	6.0	6.0	6.0
April	9.0	9.5	10.0	10.3	7.6	8.4	8.8	8.4	6.5	6.5	6.7	6.9
May	7.8	8.8	9.6	10.2	8.6	8.8	9.4	9.2	6.8	6.9	6.9	6.9
June	6.1	8.1	9.0	9.8	8.9	9.1	9.7	9.4	7.2	7.2	7.2	7.2
July	7.6	8.6	9.4	10.0	8.9	9.1	9.7	9.5	7.2	7.2	7.2	7.2
August	10.1	10.6	11.4	11.4	9.0	9.3	9.7	9.5	6.9	6.9	6.9	6.9
September	12.6	12.7	12.8	12.8	9.1	9.3	9.6	9.5	6.4	6.4	6.4	6.4
October	11.1	11.1	10.7	10.8	7.9	8.0	8.2	8.0	5.7	5.6	5.4	5.4
November	10.5	10.0	9.6	9.4	8.1	8.9	7.8	7.9	5.3	5.0	4.8	4.7

East or West Wall — Table 5b — Latitude 30°

Solar Time East	Solar Time West	I_o	30° Slope backward i	30° Slope backward cos i	30° Slope backward $I_o \cos i$	60° Slope backward i	60° Slope backward cos i	60° Slope backward $I_o \cos i$	Horizontal i	Horizontal cos i	Horizontal $I_o \cos i$
December											
8 a.m.,	4 p.m.	194.0	58	0.792	153.7	55	0.567	110.1	79	0.191	37.0
9 a.m.,	3 p.m.	265.0	42	0.741	196.3	51	0.633	167.7	69	0.358	95.0
10 a.m.,	2 p.m.	286.0	50	0.644	184.3	49	0.651	186.3	61	0.485	138.5
11 a.m.,	1 p.m.	296.0	60	0.495	146.4	52	0.616	182.3	55	0.574	169.7
12 noon		298.7	73	0.300	89.8	59	0.521	155.5	53	0.602	179.7
1 p.m.,	11 a.m.	296.0	85	0.079	23.5	68	0.376	111.3	55	0.574	169.7
2 p.m.,	10 a.m.	286.0				79	0.188	53.8	61	0.485	138.5
Jan. or Nov.											
7 a.m.,	5 p.m.	80.0	35	0.823	65.8	60	0.505	40.4	87	0.052	4.2
8 a.m.,	4 p.m.	218.0	33	0.834	182.0	45	0.705	158.6	77	0.225	49.1
9 a.m.,	3 p.m.	277.0	39	0.782	216.7	46	0.690	191.0	66	0.407	112.7
10 a.m.,	2 p.m.	294.0	48	0.666	195.7	46	0.690	203.0	58	0.530	155.8
11 a.m.,	1 p.m.	304.0	59	0.520	157.8	48	0.667	203.0	52	0.616	187.2
12 noon		308.0	71	0.322	99.2	56	0.557	171.5	50	0.643	198.0
1 p.m.,	11 a.m.	304.0	84	0.097	29.5	65	0.424	128.8	52	0.616	187.2
2 p.m.,	10 a.m.	294.0				77	0.228	67.0	58	0.530	155.8
5 p.m.,	9 a.m.	277.0				89	0.018	5.1	66	0.407	112.7
Feb. or Oct.											
7 a.m.,	5 p.m.	152.0	27	0.891	135.4	54	0.594	90.4	82	0.139	21.2
8 a.m.,	4 p.m.	251.0	27	0.888	223.0	46	0.692	173.5	72	0.309	77.6
9 a.m.,	3 p.m.	286.0	31	0.853	244.0	40	0.770	220.3	61	0.485	138.7
10 a.m.,	2 p.m.	301.0	42	0.739	222.5	38	0.788	237.4	51	0.629	189.3
11 a.m.,	1 p.m.	308.0	54	0.586	180.3	41	0.754	232.2	44	0.719	221.5
12 noon		313.5	68	0.381	119.5	49	0.659	206.5	40	0.766	240.2
1 p.m.,	11 a.m.	308.0	82	0.135	41.5	60	0.494	152.0	44	0.719	221.5
2 p.m.,	10 a.m.	301.0				73	0.300	90.4	51	0.629	189.3
3 p.m.,	9 a.m.	286.0				86	0.071	20.3	61	0.485	138.7
Mar. or Sept.											
6 a.m.,	6 p.m.	56.0	25	0.906	50.8	55	0.573	32.1	85	0.087	4.9
7 a.m.,	5 p.m.	157.0	16	0.962	151.0	46	0.692	108.5	76	0.242	38.0
8 a.m.,	4 p.m.	223.0	14	0.971	216.5	36	0.813	181.4	64	0.438	97.8
9 a.m.,	3 p.m.	258.9	23	0.923	238.9	28	0.880	227.8	53	0.602	155.6
10 a.m.,	2 p.m.	274.6	36	0.814	223.5	25	0.906	248.9	41	0.755	207.2
11 a.m.,	1 p.m.	283.3	50	0.648	183.3	31	0.859	243.2	32	0.848	239.4
12 noon		286.5	64	0.437	125.4	42	0.748	214.3	29	0.875	250.8
1 p.m.,	11 a.m.	283.3	78	0.202	57.1	53	0.601	170.4	32	0.848	239.4
2 p.m.,	10 a.m.	274.6				66	0.404	110.8	41	0.755	207.2
3 p.m.,	9 a.m.	258.9				81	0.162	42.0	53	0.602	155.6
Apr. or Aug.											
6 a.m.,	6 p.m.	69.0	18	0.950	65.6	54	0.593	40.9	83	0.122	8.4
7 a.m.,	5 p.m.	202.8	10	0.985	199.7	39	0.777	157.5	69	0.358	72.8
8 a.m.,	4 p.m.	241.0	4	0.998	240.5	28	0.883	212.8	58	0.530	127.7
9 a.m.,	3 p.m.	270.4	19	0.946	255.6	16	0.961	260.0	44	0.719	194.5
10 a.m.,	2 p.m.	282.5	33	0.842	238.0	14	0.970	274.0	33	0.839	237.0
11 a.m.,	1 p.m.	289.4	47	0.676	195.6	22	0.926	268.0	22	0.927	268.3
12 noon		290.0	62	0.476	138.0	35	0.823	239.0	18	0.951	276.0
1 p.m.,	11 a.m.	289.4	75	0.251	72.5	47	0.680	196.5	22	0.927	268.3
2 p.m.,	10 a.m.	282.5				61	0.482	136.0	33	0.839	237.0
3 p.m.,	9 a.m.	270.4				88	0.037	8.9	44	0.719	194.5
May or July											
6 a.m.,	6 p.m.	107.5	25	0.904	97.0	52	0.622	66.8	80	0.174	18.7
7 a.m.,	5 p.m.	207.2	13	0.976	202.2	39	0.780	161.5	68	0.375	77.7
8 a.m.,	4 p.m.	252.2	6	0.994	250.8	24	0.914	230.5	54	0.588	148.0
9 a.m.,	3 p.m.	273.4	18	0.950	259.8	12	0.978	267.3	42	0.743	203.0
10 a.m.,	2 p.m.	285.5	33	0.836	239.0	12	0.977	279.0	29	0.875	249.7
11 a.m.,	1 p.m.	291.3	46	0.692	201.4	17	0.954	277.9	17	0.956	278.4
12 noon		293.0	61	0.491	143.8	32	0.852	250.0	10	0.985	288.5
1 p.m.,	11 a.m.	291.3	75	0.267	77.6	45	0.707	206.0	17	0.956	278.4
2 p.m.,	10 a.m.	285.5	89	0.018	5.3	60	0.505	144.0	29	0.875	249.7
3 p.m.,	9 a.m.	273.4				72	0.309	84.6	42	0.743	203.0
4 p.m.,	8 a.m.	252.2				85	0.091	23.0	54	0.588	148.0
June											
6 a.m.,	6 p.m.	149.9	25	0.905	135.6	49	0.652	97.8	77	0.225	33.8
7 a.m.,	5 p.m.	237.9	10	0.986	234.5	30	0.866	206.0	59	0.515	122.6
8 a.m.,	4 p.m.	254.6	10	0.986	251.0	11	0.982	250.0	53	0.602	153.1
9 a.m.,	3 p.m.	276.9	21	0.934	258.5	8	0.990	274.0	39	0.777	215.2
10 a.m.,	2 p.m.	286.7	31	0.859	246.4	11	0.983	282.0	27	0.891	255.2
11 a.m.	1 p.m.	292.2	47	0.677	197.9	18	0.951	278.0	14	0.970	283.5
12 noon		293.1	61	0.479	140.4	30	0.862	253.0	6	0.995	291.5
1 p.m.,	11 a.m.	292.2	73	0.294	86.0	43	0.730	213.5	14	0.970	283.5
2 p.m.,	10 a.m.	286.7	87	0.037	16.4	56	0.560	160.4	27	0.891	255.2
3 p.m.,	9 a.m.	276.9				69	0.359	99.4	39	0.777	215.2
4 p.m.,	8 a.m.	254.6				83	0.126	32.0	53	0.602	153.1
5 p.m.,	7 a.m.	237.9				89	0.025	6.0	59	0.515	122.6

East or West Wall — Table 6b — Latitude 35°

Solar Time East	Solar Time West	I_o	30° Slope backward i	30° Slope backward cos i	30° Slope backward $I_o \cos i$	60° Slope backward i	60° Slope backward cos i	60° Slope backward $I_o \cos i$	Horizontal i	Horizontal cos i	Horizontal $I_o \cos i$
December											
8 a.m.,	4 p.m.	179.0	39	0.776	138.9	47	0.687	123.0	80	0.174	31.1
9 a.m.,	3 p.m.	239.0	45	0.711	170.0	54	0.589	138.5	73	0.292	69.9
10 a.m.,	2 p.m.	267.0	52	0.611	163.2	55	0.574	157.0	66	0.407	108.6
11 a.m.,	1 p.m.	279.0	62	0.462	128.9	57	0.541	151.0	61	0.485	135.2
12 noon		287.6	75	0.265	76.2	65	0.459	131.9	58	0.530	152.4
1 p.m.,	11 a.m.	279.0	88	0.035	9.8	73	0.300	83.8	61	0.485	135.2
2 p.m.,	10 a.m.	267.0				85	0.118	31.4	66	0.407	108.6
Jan. or Nov.											
8 a.m.,	4 p.m.	196.0	37	0.800	156.7	55	0.575	112.2	79	0.191	37.4
9 a.m.,	3 p.m.	268.0	41	0.751	201.2	50	0.640	171.5	69	0.358	96.1
10 a.m.,	2 p.m.	287.0	50	0.641	184.0	50	0.641	184.0	62	0.470	134.8
11 a.m.,	1 p.m.	294.0	61	0.480	141.0	54	0.583	171.4	58	0.530	155.9
12 noon		300.0	73	0.287	86.0	60	0.497	149.0	55	0.574	172.0
1 p.m.,	11 a.m.	294.0	87	0.050	14.8	70	0.335	98.0	58	0.530	155.9
2 p.m.,	10 a.m.	287.0				80	0.173	49.6	62	0.470	134.8
Feb. or Oct.											
8 a.m.,	4 p.m.	245.0	29	0.878	215.0	47	0.676	165.5	73	0.292	71.7
9 a.m.,	3 p.m.	282.0	33	0.835	235.2	42	0.744	209.9	63	0.454	128.0
10 a.m.,	2 p.m.	297.0	44	0.717	212.8	41	0.754	224.0	54	0.588	174.5
11 a.m.,	1 p.m.	303.0	56	0.552	167.3	46	0.696	211.0	49	0.656	198.8
12 noon		308.9	69	0.354	109.1	52	0.613	189.2	45	0.707	218.2
1 p.m.,	11 a.m.	303.0	84	0.104	31.5	64	0.438	132.6	49	0.656	198.8
2 p.m.,	10 a.m.	297.0				75	0.266	79.0	54	0.588	174.5
3 p.m.,	9 a.m.	282.0				88	0.042	11.9	63	0.454	128.0
Mar. or Sept.											
6 a.m.,	6 p.m.	56.0	26	0.899	50.4	55	0.573	32.1	85	0.087	4.9
7 a.m.,	5 p.m.	157.0	17	0.954	149.8	46	0.690	108.4	76	0.242	38.0
8 a.m.,	4 p.m.	223.0	15	0.964	215.0	36	0.810	180.7	64	0.438	97.8
9 a.m.,	3 p.m.	258.9	25	0.908	235.0	31	0.860	231.0	55	0.574	148.4
10 a.m.,	2 p.m.	273.4	38	0.783	214.3	28	0.884	241.7	42	0.743	203.2
11 a.m.,	1 p.m.	280.8	51	0.628	176.4	35	0.823	231.2	35	0.819	230.0
12 noon		283.5	65	0.424	119.1	45	0.735	208.5	32	0.848	240.3
1 p.m.,	11 a.m.	280.8	79	0.192	54.0	55	0.572	160.5	35	0.819	230.0
2 p.m.,	10 a.m.	273.4				66	0.403	110.2	42	0.743	203.2
3 p.m.,	9 a.m.	258.9				82	0.139	36.1	55	0.574	148.4
Apr. or Aug.											
6 a.m.,	6 p.m.	83.5	24	0.915	76.4	53	0.608	50.8	82	0.139	11.6
7 a.m.,	5 p.m.	189.8	11	0.981	186.2	41	0.755	143.2	71	0.326	61.8
8 a.m.,	4 p.m.	241.0	6	0.994	239.5	28	0.879	211.9	58	0.530	127.7
9 a.m.,	3 p.m.	267.7	20	0.940	251.5	19	0.944	253.0	46	0.695	186.1
10 a.m.,	2 p.m.	281.6	35	0.821	231.3	18	0.952	268.0	34	0.829	233.4
11 a.m.,	1 p.m.	287.2	48	0.669	192.0	25	0.906	260.2	26	0.899	258.0
12 noon		289.1	62	0.463	134.0	37	0.802	232.0	22	0.927	268.0
1 p.m.,	11 a.m.	287.2	77	0.235	66.8	46	0.698	200.4	26	0.899	258.0
2 p.m.,	10 a.m.	281.6	89	0.009	2.4	61	0.483	136.0	34	0.829	233.4
3 p.m.,	9 a.m.	267.7				75	0.259	69.4	46	0.695	186.1
4 p.m.,	8 a.m.	241.0				88	0.038	9.1	58	0.530	127.7
May or July											
6 a.m.,	6 p.m.	133.5	24	0.914	122.0	50	0.648	86.4	78	0.208	27.8
7 a.m.,	5 p.m.	211.6	10	0.984	208.0	38	0.793	167.8	67	0.391	82.7
8 a.m.,	4 p.m.	252.2	6	0.994	250.8	24	0.913	230.3	54	0.588	148.2
9 a.m.,	3 p.m.	274.6	20	0.939	257.8	12	0.978	268.7	41	0.755	207.4
10 a.m.,	2 p.m.	284.8	33	0.835	237.9	11	0.982	279.8	30	0.866	246.7
11 a.m.,	1 p.m.	290.2	47	0.681	197.7	21	0.936	271.8	20	0.940	272.5
12 noon		291.8	61	0.483	140.9	33	0.837	244.0	15	0.966	281.6
1 p.m.,	11 a.m.	290.2	75	0.261	75.7	47	0.682	198.0	20	0.940	272.5
2 p.m.,	10 a.m.	284.8	88	0.032	9.2	59	0.519	147.6	30	0.866	246.7
3 p.m.,	9 a.m.	274.6				71	0.330	94.0	41	0.755	207.4
4 p.m.,	8 a.m.	252.2				84	0.104	26.3	54	0.588	148.2
June											
6 a.m.,	6 p.m.	157.0	24	0.916	143.8	48	0.667	104.8	76	0.242	38.0
7 a.m.,	5 p.m.	225.0	11	0.980	218.7	35	0.819	182.6	64	0.438	97.8
8 a.m.,	4 p.m.	256.7	8	0.989	254.0	22	0.927	238.0	52	0.616	158.0
9 a.m.,	3 p.m.	276.9	21	0.932	258.0	10	0.985	272.7	39	0.777	215.0
10 a.m.,	2 p.m.	286.7	33	0.842	241.3	15	0.964	276.0	27	0.891	255.4
11 a.m.,	1 p.m.	291.3	39	0.780	227.3	19	0.943	274.9	17	0.956	278.5
12 noon		292.5	61	0.489	143.0	32	0.848	248.0	12	0.978	286.0
1 p.m.,	11 a.m.	291.3	71	0.326	94.8	44	0.716	208.6	17	0.956	278.5
2 p.m.,	10 a.m.	286.7	86	0.071	20.4	55	0.569	163.0	27	0.891	255.4
3 p.m.,	9 a.m.	276.9				69	0.359	99.3	39	0.777	215.0
4 p.m.,	8 a.m.	256.7				82	0.141	36.1	52	0.616	158.0

HPAC DATA SHEET

East or West Wall — Table 7b — Latitude 40°

Solar Time East	Solar Time West	I_o	30° Slope backward i	30° Slope backward cos i	30° Slope backward $I_o$cos i	60° Slope backward i	60° Slope backward cos i	60° Slope backward $I_o$cos i	Horizontal i	Horizontal cos i	Horizontal $I_o$cos i
December											
8 a.m.,	4 p.m.	168.0	40	0.770	129.3	58	0.535	89.8	81	0.156	26.3
9 a.m.,	3 p.m.	223.0	47	0.683	152.2	58	0.532	118.7	76	0.242	54.0
10 a.m.,	2 p.m.	261.0	56	0.565	147.5	58	0.524	136.9	70	0.342	89.2
11 a.m.,	1 p.m.	274.0	66	0.409	112.0	62	0.471	129.1	66	0.407	111.5
12 noon		276.8	78	0.211	58.5	69	0.365	101.1	65	0.423	117.0
1 p.m.,	11 a.m.	274.0				76	0.234	64.2	66	0.407	111.5
2 p.m.,	10 a.m.	261.0				86	0.069	18.0	70	0.342	89.2
Jan. or Nov.											
8 a.m.,	4 p.m.	170.0	38	0.788	134.0	57	0.545	92.7	81	0.156	26.6
9 a.m.,	3 p.m.	240.0	44	0.717	172.0	55	0.570	136.7	74	0.276	66.2
10 a.m.,	2 p.m.	277.0	52	0.612	169.4	54	0.588	163.0	66	0.407	112.7
11 a.m.,	1 p.m.	287.0	63	0.459	131.5	58	0.535	153.7	62	0.470	134.9
12 noon		288.0	76	0.243	69.8	65	0.420	121.0	61	0.485	139.7
1 p.m.,	11 a.m.	287.0	89	0.011	3.2	74	0.278	79.6	62	0.470	134.9
2 p.m.,	10 a.m.	277.0				83	0.118	32.6	66	0.407	112.7
Feb. or Oct.											
7 a.m.,	5 p.m.	152.0	28	0.886	134.7	54	0.592	90.0	82	0.139	21.2
8 a.m.,	4 p.m.	232.0	30	0.870	201.9	49	0.650	150.9	75	0.259	60.0
9 a.m.,	3 p.m.	274.0	37	0.802	219.7	46	0.698	191.2	66	0.407	111.5
10 a.m.,	2 p.m.	291.0	47	0.686	199.7	45	0.703	204.7	58	0.530	154.1
11 a.m.	1 p.m.	298.0	59	0.515	153.5	50	0.645	192.3	53	0.602	179.5
12 noon		304.5	72	0.315	95.2	57	0.545	165.8	51	0.629	191.7
1 p.m.,	11 a.m.	298.0	85	0.088	26.1	67	0.398	118.6	53	0.602	179.5
2 p.m.,	10 a.m.	291.0				77	0.217	63.0	58	0.530	154.1
3 p.m.,	9 a.m.	274.0				89	0.008	2.2	66	0.407	111.5
Mar. or Sept.											
6 a.m.,	6 p.m.	56.0	25	0.907	50.8	55	0.574	32.1	85	0.087	4.9
7 a.m.,	5 p.m.	133.5	20	0.938	125.5	48	0.663	88.5	78	0.208	27.8
8 a.m.,	4 p.m.	215.6	19	0.948	204.3	39	0.782	168.5	66	0.407	87.8
9 a.m.,	3 p.m.	247.0	27	0.889	219.5	33	0.836	206.5	56	0.559	138.1
10 a.m.,	2 p.m.	264.5	39	0.774	204.7	33	0.834	221.0	48	0.669	177.0
11 a.m.,	1 p.m.	274.6	53	0.601	165.0	38	0.783	215.0	41	0.755	207.4
12 noon		277.0	67	0.388	107.5	48	0.672	186.1	39	0.777	215.2
1 p.m.,	11 a.m.	274.6	81	0.157	43.1	58	0.527	144.7	41	0.755	207.4
2 p.m.,	10 a.m.	264.5				71	0.327	66.0	48	0.669	177.0
3 p.m.,	9 a.m.	247.0				82	0.133	32.9	56	0.559	138.1
Apr. or Aug.											
6 a.m.,	6 p.m.	98.0	23	0.923	90.4	51	0.623	61.0	81	0.156	15.3
7 a.m.,	5 p.m.	196.3	10	0.984	193.1	40	0.765	150.0	70	0.342	67.1
8 a.m.,	4 p.m.	237.9	8	0.989	235.2	30	0.868	206.5	59	0.515	122.5
9 a.m.,	3 p.m.	264.4	21	0.931	246.3	22	0.924	244.4	48	0.669	177.0
10 a.m.,	2 p.m.	278.9	36	0.814	227.0	22	0.925	257.8	38	0.788	220.0
11 a.m.,	1 p.m.	284.1	50	0.645	183.3	30	0.866	246.0	31	0.857	243.5
12 noon		286.8	63	0.457	131.0	38	0.791	226.8	27	0.891	255.7
1 p.m.,	11 a.m.	284.1	78	0.213	60.4	52	0.617	175.3	31	0.857	243.5
2 p.m.,	10 a.m.	278.9				64	0.440	122.5	38	0.788	220.0
3 p.m.,	9 a.m.	264.4				69	0.358	94.6	48	0.669	177.0
4 p.m.,	8 a.m.	237.9				89	0.025	58.2	59	0.515	122.5
May or July											
6 a.m.,	6 p.m.	149.9	22	0.924	138.3	48	0.663	99.4	77	0.225	33.8
7 a.m.,	5 p.m.	211.6	10	0.986	208.6	38	0.793	167.6	67	0.391	82.7
8 a.m.,	4 p.m.	249.8	5	0.996	249.0	25	0.905	226.0	55	0.574	143.3
9 a.m.,	3 p.m.	272.1	20	0.938	255.0	15	0.965	262.5	43	0.731	199.0
10 a.m.,	2 p.m.	282.5	34	0.833	235.3	15	0.964	272.5	33	0.839	237.0
11 a.m.,	1 p.m.	288.3	48	0.669	192.9	24	0.910	262.2	24	0.914	263.5
12 noon		290.0	62	0.470	136.4	35	0.814	236.2	20	0.940	272.5
1 p.m.,	11 a.m.	288.3	76	0.245	70.5	48	0.667	192.2	24	0.914	263.5
2 p.m.,	10 a.m.	282.5	89	0.007	1.9	61	0.488	138.0	33	0.839	237.0
3 p.m.,	9 a.m.	272.1				72	0.303	82.5	43	0.731	199.0
4 p.m.,	8 a.m.	249.8				85	0.088	21.9	55	0.574	143.3
June											
6 a.m.,	6 p.m.	165.2	22	0.926	153.0	47	0.684	113.0	75	0.259	42.8
7 a.m.,	5 p.m.	226.5	9	0.988	224.0	33	0.844	188.8	63	0.454	102.8
8 a.m.,	4 p.m.	256.7	8	0.990	254.1	22	0.929	238.5	52	0.616	158.0
9 a.m.,	3 p.m.	275.8	21	0.931	256.9	12	0.979	270.0	40	0.766	211.2
10 a.m.,	2 p.m.	285.5	35	0.817	233.5	13	0.975	278.5	29	0.875	250.0
11 a.m.,	1 p.m.	289.8	48	0.671	194.5	22	0.937	268.8	21	0.934	271.0
12 noon		290.8	61	0.481	139.8	34	0.832	242.0	16	0.961	279.3
1 p.m.,	11 a.m.	289.8	75	0.264	81.4	46	0.693	200.7	21	0.934	271.0
2 p.m.,	10 a.m.	285.5	87	0.056	16.1	58	0.537	153.2	29	0.875	250.0
3 p.m.,	9 a.m.	275.8				70	0.347	94.2	40	0.766	211.2
4 p.m.,	8 a.m.	256.7				82	0.140	35.9	52	0.616	158.0

East or West Wall — Table 8b — Latitude 45°

Solar Time East	Solar Time West	I_o	30° Slope backward i	30° Slope backward cos i	30° Slope backward $I_o$cos i	60° Slope backward i	60° Slope backward cos i	60° Slope backward $I_o$cos i	Horizontal i	Horizontal cos i	Horizontal $I_o$cos i
December											
8 a.m.,	4 p.m.	168.0	38	0.783	131.5	58	0.530	89.0	81	0.156	16.3
9 a.m.,	3 p.m.	194.0	49	0.654	127.0	61	0.488	94.6	79	0.191	37.0
10 a.m.,	2 p.m.	215.0	59	0.510	109.5	63	0.451	97.0	77	0.225	48.4
11 a.m.,	1 p.m.	251.0	68	0.368	92.4	67	0.391	98.2	72	0.309	77.6
12 noon		260.0	80	0.179	46.6	72	0.311	80.7	69	0.358	93.3
1 p.m.,	11 a.m.	251.0				82	0.145	36.3	72	0.309	77.6
Jan. or Nov.											
8 a.m.,	4 p.m.	154.0	39	0.772	118.9	58	0.526	81.1	82	0.139	21.4
9 a.m.,	3 p.m.	218.0	47	0.688	150.0	58	0.528	115.1	77	0.225	49.1
10 a.m.,	2 p.m.	248.0	56	0.561	139.1	61	0.492	122.1	73	0.292	72.6
11 a.m.,	1 p.m.	271.0	66	0.409	110.8	63	0.453	122.7	68	0.375	101.5
12 noon		280.0	78	0.211	59.2	68	0.367	102.8	65	0.423	118.4
1 p.m.,	11 a.m.	271.0				79	0.197	53.4	68	0.375	101.5
2 p.m.,	10 a.m.	248.0				89	0.014	35.5	73	0.292	72.6
Feb. or Oct.											
8 a.m.,	4 p.m.	215.0	32	0.851	182.9	52	0.620	133.5	77	0.225	48.4
9 a.m.,	3 p.m.	268.0	38	0.784	210.0	48	0.670	179.5	68	0.375	100.5
10 a.m.,	2 p.m.	282.0	49	0.658	185.6	50	0.643	181.3	63	0.454	128.2
11 a.m.,	1 p.m.	291.0	61	0.480	139.7	54	0.583	169.5	58	0.530	154.2
12 noon		296.7	73	0.287	85.0	60	0.497	147.5	55	0.574	170.0
1 p.m.,	11 a.m.	291.0	87	0.050	14.7	70	0.335	97.0	58	0.530	154.2
2 p.m.,	10 a.m.	282.0				82	0.145	40.8	63	0.454	128.2
Mar. or Sept.											
6 a.m.,	6 p.m.	56.0	25	0.906	50.7	55	0.574	32.1	85	0.087	4.9
7 a.m.,	5 p.m.	117.0	21	0.932	109.1	50	0.648	75.8	79	0.191	22.3
8 a.m.,	4 p.m.	207.2	21	0.932	193.1	41	0.750	155.3	68	0.375	77.7
9 a.m.,	3 p.m.	237.9	30	0.865	205.9	37	0.797	189.5	59	0.515	122.5
10 a.m.,	2 p.m.	258.9	42	0.748	193.5	37	0.795	205.9	51	0.629	162.8
11 a.m.,	1 p.m.	267.7	55	0.571	152.7	43	0.729	195.1	46	0.695	186.2
12 noon		270.6	69	0.358	96.8	52	0.617	167.0	44	0.719	194.8
1 p.m.,	11 a.m.	267.7	83	0.124	33.2	62	0.471	126.1	46	0.695	186.2
2 p.m.,	10 a.m.	258.9				73	0.295	76.4	51	0.629	162.8
3 p.m.,	9 a.m.	237.9				85	0.094	22.4	59	0.515	122.5
Apr. or Aug.											
6 a.m.,	6 p.m.	98.0	22	0.924	90.6	55	0.575	96.3	81	0.156	15.3
7 a.m.,	5 p.m.	196.3	10	0.984	193.0	45	0.707	139.0	70	0.342	67.2
8 a.m.,	4 p.m.	235.1	11	0.980	230.4	31	0.854	201.0	60	0.500	117.5
9 a.m.,	3 p.m.	260.4	23	0.918	239.1	25	0.903	248.0	50	0.643	167.5
10 a.m.,	2 p.m.	274.6	38	0.798	218.0	24	0.915	251.2	41	0.755	207.3
11 a.m.,	1 p.m.	280.8	51	0.628	176.2	33	0.834	234.0	35	0.819	230.0
12 noon		283.5	65	0.424	120.2	43	0.734	208.0	32	0.848	240.5
1 p.m.,	11 a.m.	280.8	79	0.192	53.9	54	0.583	163.5	35	0.819	230.0
2 p.m.,	10 a.m.	274.6				66	0.414	113.5	41	0.755	207.3
3 p.m.,	9 a.m.	260.4				78	0.214	55.7	50	0.643	167.5
4 p.m.,	8 a.m.	235.1				89	0.011	2.7	60	0.500	117.5
May or July											
6 a.m.,	6 p.m.	157.0	19	0.946	147.0	47	0.681	103.5	76	0.242	38.0
7 a.m.,	5 p.m.	219.6	6	0.994	218.3	35	0.819	180.0	65	0.423	92.9
8 a.m.,	4 p.m.	249.8	8	0.991	247.8	25	0.904	225.8	55	0.574	143.2
9 a.m.,	3 p.m.	269.3	21	0.933	251.5	18	0.951	256.4	45	0.707	190.7
10 a.m.,	2 p.m.	280.8	35	0.816	229.1	10	0.943	264.7	35	0.819	230.0
11 a.m.,	1 p.m.	286.1	49	0.651	186.4	30	0.865	248.0	28	0.883	252.5
12 noon		287.8	63	0.454	130.5	39	0.782	225.0	25	0.906	261.0
1 p.m.,	11 a.m.	286.1	77	0.231	66.2	51	0.623	178.5	28	0.883	253.5
2 p.m.,	10 a.m.	280.8	89	0.002	0.7	62	0.473	132.8	35	0.819	230.0
3 p.m.,	9 a.m.	269.3				74	0.279	75.2	45	0.707	190.7
4 p.m.,	8 a.m.	249.8				85	0.090	22.4	55	0.574	143.2
June											
6 a.m.,	6 p.m.	172.1	20	0.941	162.1	45	0.710	122.2	74	0.276	47.5
7 a.m.,	5 p.m.	226.5	6	0.995	225.3	33	0.837	189.7	63	0.454	102.8
8 a.m.,	4 p.m.	256.7	8	0.991	254.3	22	0.926	237.5	52	0.616	158.1
9 a.m.,	3 p.m.	273.4	19	0.944	258.0	8	0.990	270.8	42	0.743	203.5
10 a.m.,	2 p.m.	283.3	27	0.889	252.0	16	0.960	272.0	32	0.848	240.3
11 a.m.,	1 p.m.	287.8	40	0.658	189.4	25	0.904	260.0	25	0.906	261.5
12 noon		289.9	62	0.466	135.2	36	0.809	234.5	21	0.934	271.5
1 p.m.,	11 a.m.	287.8	76	0.250	71.6	48	0.666	191.9	25	0.906	261.5
2 p.m.,	10 a.m.	283.3	84	0.111	31.6	59	0.511	144.7	32	0.848	240.3
3 p.m.,	9 a.m.	273.4				70	0.347	93.8	42	0.743	203.5
4 p.m.,	8 a.m.	256.7				82	0.141	36.2	52	0.616	158.1

HEATING, PIPING & AIR CONDITIONING
AMERICAN SOCIETY OF
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Evaluation of Equipment Noise

By H. C. Hardy* and D. E. Bishop**, Chicago, Ill.

SUMMARY — A brief survey is made of the present state of knowledge to permit stating what is not known and to outline needed research. Certain concepts of modern acoustical engineering are suggested as offering a means for measuring and evaluating noise of heating, ventilating and air-conditioning equipment. Methods of procedure are outlined and a simple layout for applying the ideas to fans is included. Two examples illustrate proposed procedures. Specific suggestions are made covering the data missing and needed in order to make the noise determinations.

THE SOUND level meter, invented approximately 25 years ago, is an instrument which measures the minute alterations of pressure in the atmosphere that we call sound waves. The magnitude of such pressure fluctuations is small. A pressure fluctuation of about one millionth of one atmosphere (one dyne per square centimeter or approximately 0.0004 in. of water) gives a sound pressure level of 74 db. Fig. 1 gives an idea of the magnitude of these sound waves.

The meter is the basic instrument for measuring sound, but a reading of the meter alone is inadequate to determine the effect of sound just as a measurement of temperature at a point on a wall presents an inadequate measure of the heat input into the room and the effect it has on the people in it. What is really needed in the acoustical case is knowledge of:

(*a*) How much sound energy is emitted by the sound source and where the sound energy is going; and

(*b*) How an individual reacts to this sound energy, in particular how loud it is to him.

In a manner similar to that used to compute the aerodynamic energy flow and pressure drops in a hydraulic system, it is possible to follow the acoustic energy transfer by obtaining the acoustic power output of the source and the losses along various paths. Power output and losses, however, will vary considerably with frequency, and the human reaction can only be interpreted in terms of the acoustic energy distribution with frequency. It is essential, therefore, that measurements be distributed over several frequency bands.

It should be evident that, only when the knowledge requirements (*a*) and (*b*) given in the preceding paragraph are established, is it possible to design the systems intelligently or efficiently. A considerable part of this paper explains how these data can be obtained for air flow systems.

Relations Between Sound Pressure and Energy

A more basic unit than sound pressure, but one which is not directly measured is sound intensity (I), the amount of energy per second passing through a unit area. For a plane wave or a spherically diverging sound source in open air (free field) the intensity (I_F) is related to the sound pressure (p_F) by the relation

$$I_F = p^2_F/\rho c \quad \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

where

ρ = density of the air.
c = the velocity of sound at room temperature.
ρc = 42 cgs units.

When the sound is completely random in a room (a condition which

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is approximately true in any large room at high frequencies, especially when the measurement is averaged

ly at a single measurement position. After the sound is turned on, a condition of equilibrium is soon reached where the power added by the sound source equals the power absorbed in the room. In such a random field, the manner in which the sound field

For the case where there is little sound absorption in the room (a hard-walled room) and at distances of several feet or more from the source:

$$P = I_R A = p^2_R A/4\rho c \quad \ldots\ldots\ldots (4)$$

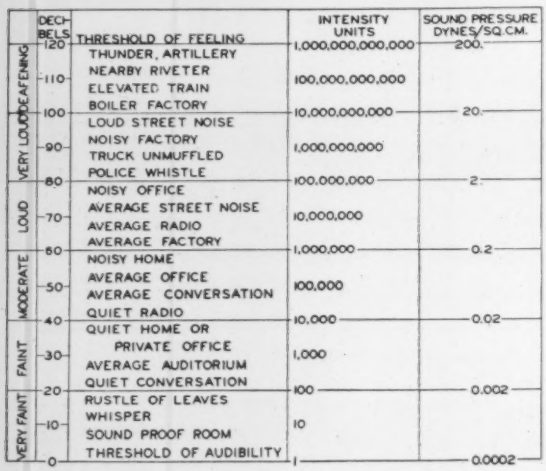

Fig. 1—Typical overall sound pressure levels for common sounds

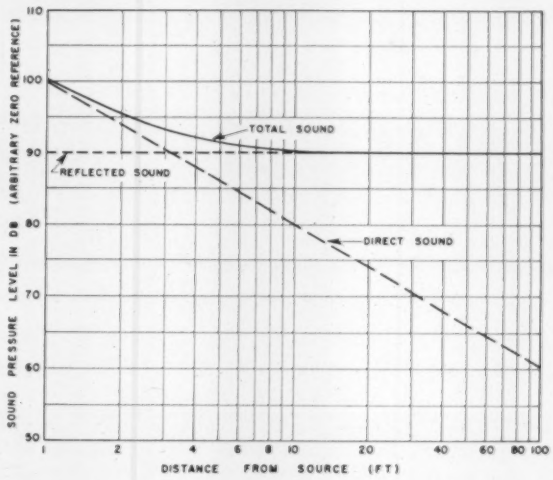

Fig. 2—Variation of noise levels with distance from a simple source in a regularly shaped room

over a band of frequencies) the relationship is

$$I_R = p^2_R/4\rho c \quad \ldots\ldots\ldots\ldots\ldots (2)$$

In any particular space in which the geometry is not simple, the relationship between the sound pressure and the intensity cannot usually be calculated[1].

The total power (P) (energy per second) emitted by a spherical sound source radiating in free space would be

$$P = 4\pi r^2 I_V = 4\pi r^2 \ (p^2_V/\rho c) \quad \ldots\ldots (3)$$

where

r = the distance from the source to the point where the sound pressure p_V is measured.

When the sound source is not symmetrical, as is often the case, the power can only be found by numerical integration of measurements made in many directions.

In a random sound field (an enclosed reverberant space) this integration can be obtained automatically

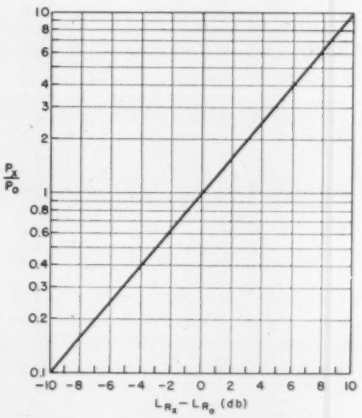

Fig. 3—Comparison of the sound power output ratio between unknown and standard sources with the difference between reverberant sound pressure levels

changes with distance is shown in Fig. 2. At first the sound level decreases, as given by Equation 3, but soon the direct sound is lost in the energy reflected from other surfaces, and the intensity becomes almost uniform and independent of the distance from the source[2]. The random level in the room will depend only on the total absorption; the higher the absorption, the lower the level.

where

p_R = the random sound pressure level.
A = the total sound absorption in the room, equal to:

$$A = A_o + \Sigma S_i \alpha_i \quad \ldots\ldots\ldots (5)$$

where

A_o = the air absorption.
S_i = the area of a surface.
α_i = the absorption coefficient of that surface.

Random Field Measurements

The foregoing statements were necessary to give an understanding of how the sound power emitted by a heating and ventilating unit can be evaluated from sound level measurements. It can be seen from Equation 3 that generally in free space the sound level measurements vary considerably with distance and usually with angle. It is suggested, therefore, that the sound power be measured when possible in random field conditions. These are conditions which exist approximately in most indoor spaces.

It is proposed, therefore, that standards on sound output be written

[1]Exponent numerals refer to References.

in terms of sound power emitted into a random space. It will be necessary in the general case that some constants of the room and measuring equipment be known. However, in the specific case it will not be necessary to know the absorption of the measuring room or the calibration of the sound level meter since every measurement can be a comparison measurement against a standard known source. Thus the P_x of the unknown will be related to the power of the standard P_o, *viz*

$$P_x/P_o = p_{Rx}^2/p_{Ro}^2 \quad \ldots\ldots\ldots\ldots (6)$$

$$10 \log P_x/P_o = 20 \log p_{Rx} - 20 \log p_{Ro} = L_{Rx} - L_{Ro}$$

$$P_x/P_o = \text{antilog } 1/10\ (L_{Rx} - L_{Ro}) \quad \ldots\ldots\ldots\ldots (7)$$

where

L_{Rx} and L_{Ro} = the random sound levels in the same room when sound sources P_x and P_o are interchanged.

Fig. 3 is a chart which gives P_x/P_o as a function of $L_{Rx} - L_{Ro}$.

The standard unit can be either a comparison machine which is run under standard conditions or it can be an artificial sound source created by playing a particular kind of noise through a loudspeaker unit. The calibration can be obtained from either elaborate free-field measurements or from measurements in a reverberation room used for determining the absorption of acoustical materials[3]. Fig. 4 shows one such laboratory.

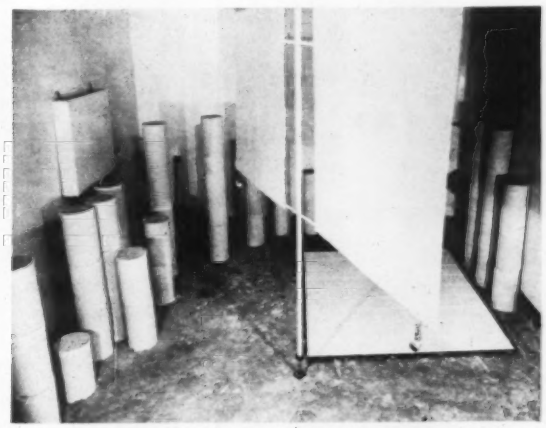

Fig. 4—Interior of the Riverbank reverberation chamber, a room used to determine the sound absorption of acoustical materials

Measurement of Fans

Let us see, for example, how this method could be applied to the measurement of the acoustical power output of industrial fans. Fig. 5 shows a possible test setup for measuring such fans. The fan is placed in a fan room A which is connected to a measurement room B, each of which is made as acoustically alive as possible. It is desired to measure the noise power produced in the intake, the exhaust, and in the fan room itself. The noise radiated by the motor and fan mechanism is measured in room A and compared with a standard source. The exhaust noise is measured by attaching a portable noise attenuating labyrinth to the intake. This is later attached to the exhaust so that the intake noise energy can be measured. Provision is made for the control and measurement of air flow at either intake or exhaust. In general, only one sound level measurement need be made for each measurement condition, although measurements at several positions may be used at low frequencies to get a better average.

How to Use Noise Power Data

Given the amount of sound power produced by a fan — which, for reasons given later, need to be measured at a number of frequencies — the useful acoustical calculations can be made. For instance, knowing the acoustic power produced in the exhaust duct, calculations can be made of:

1. The amount of sound power taken off at each branch point. (Generally, the power will divide proportionally to cross-sectional area).
2. The acoustic power absorption of acoustical lining.
3. The effect of change of cross section such as plena, lined or unlined.
4. The effect of turns.
5. The loss due to radiation through duct walls.

Finally, the amount of acoustical power arriving at each grille or outlet can be obtained. Knowing the acoustical power radiated at the outlet, the sound pressure in the room can be obtained by using either Equations 3 or 4 depending on whether information near the source or at a distance is desired.

Furthermore, if noise is regenerated in the system (for instance at the grille), the noise power so created can be evaluated by separate measurements and added at the proper place to the total power output.

Many of the data needed to give the answers in the foregoing list are still not available, chiefly because up to now there has not been a satisfactory plan on which they can be organized. With the approach outlined previously it is believed that useful working data could be obtained on various practical systems with a relatively simple measurement program.

Importance of Frequency Measurements

Up to this point little has been said about making sound pressure level measurements at different frequencies. It has been common practice in the past in the heating and ventilating profession to depend only on overall sound level measurements. These are only a little more than useless for four reasons:

1. Pieces of equipment may yield similar overall sound levels, yet their distribution of sound energy with frequency may be greatly different.
2. Our ears hear high frequencies more easily and call them louder.

3. There is a great difference in the ease of propagation of low frequencies through walls and ducts compared to high frequencies.

4. The levels of masking environmental or background noises differ widely at various frequencies.

Fortunately, there is available frequency analyzing equipment which is connected to and used to supplement the sound level meter. By far the most useful analyzer is an octave band filter which is sufficient to analyze nearly all noise measurements that need to be applied to heating and ventilating problems. This filter divides the acoustical spectrum up into slices each of which is an octave wide (an octave is a range of frequencies of two to one). The official standard octaves are: 37.5-75, 75-150, 150-300, 300-600, 600-1200, 1200-2400, 2400-4800, and 4800-9600 cycles per second (cps). The state of the art has grown to such an extent that there is little reason at present for making only overall sound level measurements.

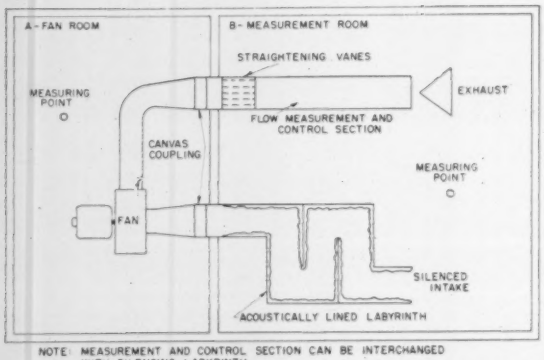

Fig. 5—Possible test room arrangement for determining the sound power output of industrial fans

Conversion of Octave Band Level to Loudness Measurement

One of the reasons why octave band level measurements are important is that they can be converted into subjective units of loudness, if it is desired to do so. It should be remarked that the conversion from physical to subjective units is never made unless one can conceive of a person actually listening at that point. For instance, calculation of the loudness inside a ventilating duct would generally be ridiculous.

The unit of loudness is a *sone* and unlike the decibel it is an arithmetic unit such that 10 sones are twice as loud as 5 sones. A graph paper for converting octave band levels to loudness is shown in Fig. 6[4]. The graph gives the loudness of the noise in each octave. The total loudness is the sum of the individual loudnesses. Not only will this scale of loudness rank various units of the same kind, but it can be used with reasonable assurance to compare the loudness of, for instance, a room air-conditioning unit with a refrigerator, or a typewriter with a fan. Final evaluation on a loudness basis also shows what portions of the frequency range are most important to consider if further quieting is needed.

It is possible, therefore, by referring to a standard distance or to standard room conditions to rank various air-conditioning or heating units by a single number system, and it is further possible to write standards using this notation.

Examples of Application

This paper will be concluded with two examples to illustrate the use of the method.

In the first example, we would like to determine the sound levels in an office caused by the ventilation supply for the office. The supply is a branch duct, attached to a main supply duct served by a centrifugal fan delivering approximately 8000 cfm. The first line of Table 1 shows the difference in the reverberant sound pressure levels between the fan exhaust and a standard source, as measured in a setup similar to that of Fig. 5. The known power output of the source is given in line 2; the sound power output, in line 3, can be determined by use of Fig. 3. For the

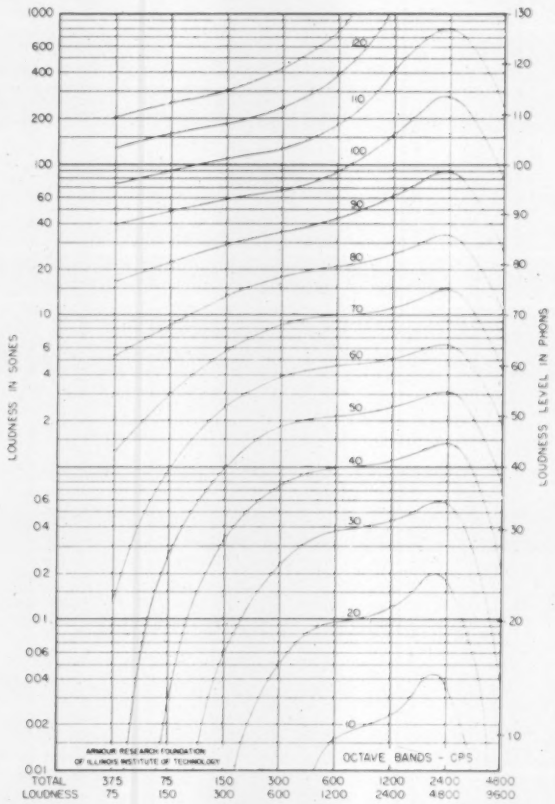

Fig. 6—Loudness graph paper, used to evaluate octave band sound pressure level measurements in terms of loudness

Table 1—Example of Typical Noise Analysis of Simple Ventilation System

	Octave Bands of Frequency, cycles per second (cps)							
	37.5 75	75 150	150 300	300 600	600 1200	1200 2400	2400 4800	4800 9600
1. $L_{RX} - L_{R0}$ (db)	+10	+5.5	+0.5	−1	−1.5	−4	−7	−10
2. P_0 (microwatts)	120	180	200	160	80	55	10	3
3. P_R (microwatts) - Main Duct	1200	640	250	125	40	14	2	0.3
4. P_X (microwatts) - Branch Duct:	120	64	25	12.5	4	1.4	0.2	0.03
5. SPL (db) — Branch Duct	90	87	83	80	75	70	62	54
6. Absorption in office (sabins)	100	140	180	220	240	260	280	300
7. SPL (db) - in office	78	73	68	64	59	54	45	37
8. Loudness (sones)	3.7	4.1	4.7	5.2	4.2	3.3	2.1	0.1
Total loudness of background ≃ 2 sones								

case of an area reduction of 10 to 1 between main and branch ducts, the sound power in the branch duct is that given in line 4 (assuming the sound power reduction is proportional to the area ratio.) Line 5 gives the sound pressure level in the branch duct, 12 in. x 18 in. in size, calculated by use of Equation 1. Line 6 gives the typical sound absorption to be found in an office 20 x 30 x 8 ft. Equation 4 can now be used to calculate the sound pressure levels in the office; these values are given in line 7 of Table 1. (These sound levels hold for positions more than about 6 ft from the grille opening.) The air conditioner. The difference in reverberant sound pressure levels between the air conditioner sound output and the standard source are given in line 1 of Table 2. For this comparison, made in a hard-walled room, the noise from the rear of the unit, which would radiate to the outside of a room in normal use was reduced by a silencing labyrinth similar to that indicated in Fig. 5. Line 3 of Table 2 shows the power output of the unit. Typical absorption values for a medium sized bedroom are shown in line 4. The reverberant sound levels in this room, calculated from Equation 4 are given in line 5, while the

Table 2—Example of Noise Analysis for ¾-Ton Air-Conditioning Unit

	Octave Bands of Frequency, cycles per second (cps)							
	37.5 75	75 150	150 300	300 600	600 1200	1200 2400	2400 4800	4800 9600
1. $L_{RX} - L_{R0}$ (db)	−21	−13.2	−12	−14	−22	−24.5	−28	−34
2. P_0 (microwatts)	120	180	200	160	80	55	10	3
3. P_X (microwatts)	0.95	8.0	12.2	6.4	0.50	0.125	0.016	0.0012
4. Absorption in bedroom (sabins)	60	80	100	110	120	130	140	160
5. SPL (db) in bedroom	59	67	68	64	53	47	37	25
6. Loudness (sones)	0.1	2.0	4.5	5.2	2.7	1.9	1.1	< 0.1
Total loudness of unit ≃ 18 sones								
7. Typical residential noise levels at night (db)	42	44	42	38	32	26	20	<15
8. Loudness (sones)	<0.01	0.08	0.41	0.60	0.46	0.26	0.18	< 0.01
Total loudness of background ≃ 2 sones								

loudness values can now be determined by use of Fig. 6 and are shown in line 8. The total loudness is 27.4 sones, the summation of the loudness in each octave band.

This example omits such effects as the sound reduction along the unlined duct, or that due to turns or bends, or grille noise. However, these necessary refinements may easily be taken into account once the acoustic performance of these parameters has been established.

Values of typical office noise spectra can now be compared with lines 7 and 8. From this comparison a quantitative estimate of the noise reduction requirements can be determined for the office supply system.

For the second example we will consider the noise output of a ¾-ton loudness values are shown in line 6. Typical background sound pressure levels and loudness values for a residence at night are given in lines 7 and 8. It can be seen that since the unit sounds over eight times as loud as the background noise, it will very likely be objectionable and probably should be quieted considerably. Examination also shows that noise reduction is most needed in the frequency region from 150 to 1200 cps.

Conclusion

This paper has presented the elements of the modern acoustical engineering techniques for handling noise measurement and control in ventilating systems. By converting sound pressure measuring data into acoustic power and its relative contribution in octave bands of frequency, it is possible to compute acoustical energy flow paths and the final subjective loudness heard by the listener.

This system of calculation has already been used by the Armed Forces Laboratories and is the basis of new standards which are being written for measurement of equipment noise. Before it can be of ultimate use to the engineering profession, however, research will have to be undertaken to obtain working data in the form of charts and tables. Such data as the following should be obtained:

1. Typical sound power spectra of fans and other air movement equipment. (Specific spectra would be the responsibility of the manufacturer.)

2. Working data on the effect of turns, branch-points, and plena on noise power propagation.

3. The noise power transmission through typical duct walls.

4. The effect of acoustical duct lining on sound attenuation for various size ducts at various frequencies.

5. The regeneration of noise by turbulence at bends, grilles, and other elements of the system as a function of velocity. (These data will be particularly important in high velocity flow systems.)

6. The acoustic absorption properties of typical rooms or spaces in which ventilation unit outlets are placed.

References

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3. Direct Measurement of the Efficiency of Loudspeakers by Use of a Reverberation Room, by H. C. Hardy, H. H. Hall, and L. G. Ramer (*Proceedings of National Electronics Conference*, Vol. 8, 1953, pp. 99-107).

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Heat Insulation

By M. W. Keyes*, Pittsburgh, Pa.

Working information concerning heat transfer and its reduction by the use of heat insulations is a basic tool. Just about every thermal engineering project starts out with an estimate of the amount of heat flowing. Such an estimate can be no more accurate than our basic information.

The ASHAE has had a continuing interest in heat insulation problems for over 30 years. Both the TRANSACTIONS and THE GUIDE have reflected this interest throughout the period.

Currently, the TAC on Insulation is concerned not only with the study of heat transfer where insulation can be used to reduce it, but also with water vapor movements in building construction. For some time, the Committee has been assisting the Guide Committee by collecting, revising and presenting comprehensive data on Heat Transmission Coefficients of Building Materials and on Pipe and Industrial Insulation as well as data on the subject of Moisture in Building Construction.

k-Factors Revised

One result of this work by the TAC has been the publication in THE GUIDE 1955 of revised conductivities and conductances for building materials and for air spaces bounded by reflective or ordinary surfaces. Similarly revised values also appear covering the materials currently used in pipe and industrial insulation.

M. W. Keyes

While much of this work of the Committee has been detailed, it has also called for the exercise of considerable judgment. For example, it has been necessary to take into account new or changed manufactured materials and new methods of construction. Existing test data have been examined and values which have appeared questionable have been replaced with the most accurate data available. On the basis of these values the TAC has selected *k*-factors to be recommended design values. Previously reported values were quotations of the results of various tests. This method of presentation permits listing of design values for the proper mean temperature for use, and for the densities of materials as commonly marketed.

New *U*-Values

At the present time, as requested by the Guide Committee, the TAC on Insulation is engaged in arranging and compiling new material which is intended to make the information on *U*-factors more readily useable. It is expected that this phase of the Committee's work may be completed in time to permit its consideration for the 1956 edition of THE GUIDE. Values for *U* are being tabulated for a large number of current constructions but presented in such a way that whenever suitable test information is available for specific elements of any construction, adjustment of the tabulated values can readily be made by a simple method outlined in the table.

This activity of the Committee has been made possible by the presence of recognized authorities in its membership; by the willingness of the Committee members to give time to intensive two-day work sessions several times a year; and by the use of sub-committees to whom specific phases of the work can be assigned.

It is expected that in the immediate future, the Committee will continue active cooperation with the Guide Committee and will also be concerned with the sponsorship of additional research projects.

* Chairman, ASHAE Technical Advisory Committee on Insulation.

Elements of Dual-Duct Design and Performance

By N. S. Shataloff*, New York, N. Y.

SUMMARY — Owing to the large number of variables affecting the performance of dual-duct systems, the method of analysis as used in this paper presents distinct advantages in predicting the resulting state of air under changing operating conditions. The basic cycles are analyzed and the effect of operation of the whole system on the performance of individual zones is described. The basic formulas and their special forms applicable to various cycles are discussed and presented in graphical form as a function of the internal heat load. Variations of the air pressure and volumes are described and illustrated. The elements of system design are outlined.

THE MOST important function of the dual-duct system is to provide flexible temperature control to a multiplicity of zones and spaces fed by one or more systems. This control is achieved by carrying two air streams at two different temperature levels, one in a *cold* and one in a *warm* duct, to the proximity of mixing units. Each mixing unit proportions air from the two ducts in response to the thermostatic control located in its conditioned room and discharges mixed air into the conditioned space at a temperature level as determined by a particular instantaneous internal load. When designed properly, any desired temperature level within the limits of the capacity of the equipment can be maintained in any zone regardless of the load level or load variation in an adjacent zone.

General Description of Systems

On Figs. 1, 2 and 3 are shown the most common arrangements of elementary dual-duct cycles for multizone systems. Other arrangements are possible, but thermodynamically they would represent only combinations and variations of these basic cycles.

With the arrangement of apparatus shown in Fig. 1 the resulting average room relative humidity is always somewhat higher than that achieved by operation of the cycles shown on Figs. 2 and 3. Care should be exercised in applying this system to installations requiring a large amount of outside air or where

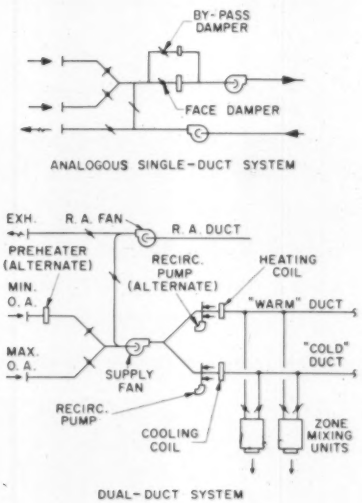

Fig. 1—Dual-duct system analogous to single-duct system with face and bypass dampers and with mixture of outside and return air bypassed around cooling coil

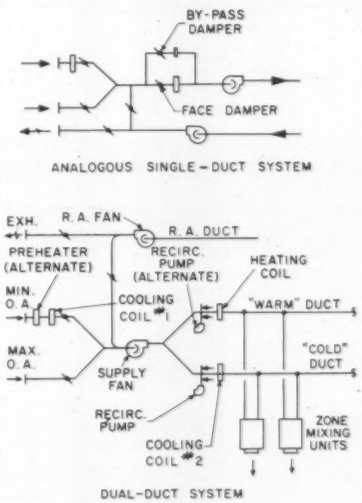

Fig. 2—Dual-duct system analogous to single-duct system of Fig. 1 but with precooling coil in the minimum outside air duct

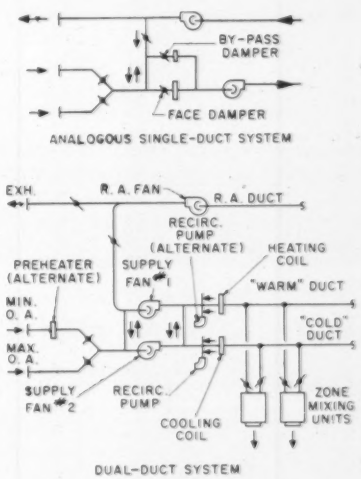

Fig. 3—Dual-duct system analogous to single-duct system with face and bypass dampers where only return air is bypassed around the air-conditioning equipment; two supply fans

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For presentation at the 62nd Annual Meeting of the AMERICAN SOCIETY OF HEATING AND AIR-CONDITIONING ENGINEERS, Cincinnati, Ohio, January 1956.

the dew point of the outside air is relatively high.

In the dual-duct system of Fig. 1 the cold air dampers in zone mixing units are functionally equivalent to the face damper of the single-duct system; warm air dampers in the zone mixing units perform the same function as the bypass damper in the single-duct system. Thermodynamically, the two systems of Fig. 1 are exactly the same, providing average resulting conditions of the dual-duct are compared to those of the single-duct system. In both cases the average conditions are represented by the state of air in the return air duct. The additional effect of operation of the dual-duct system on the performance of individual zones will be discussed in detail under Performance of Dual-Duct Cycle of Fig. 1.

With the cycle of Fig. 2 it is possible to reduce the moisture content of the outside air to any desired level before introducing it into the central system. In this manner variation in average room relative humidity can be considerably reduced, especially under partial load operation. With this cycle, the dew point of the outside air has no direct bearing on the resulting conditions inside the conditioned spaces.

The analogy of this cycle with a single-duct system as shown in Fig. 2 applies also only when average conditions of the systems are compared. The effect on operation of individual zones will be considered under Performance of Dual-Duct Cycle of Fig. 2.

The dual-duct cycle of Fig. 3 can bring about minimum variation of relative humidities in conditioned spaces. On summer partial loads when some of the outside air starts to flow into the warm duct the operation of this cycle approaches that of Fig. 1. The disadvantage of this cycle is that it might cause reduction in direct ventilation in zones which require a large amount of warm air unless the warm air temperature is raised as the zone load decreases.

Common to all the cycles shown is the provision for taking in 100 percent outside air when outside conditions are favorable. It should be noticed also that entire conditioning of the air is accomplished in centrally located apparatus, thus relieving the conditioned spaces of any mechanical equipment requiring servicing or cleaning.

Performance of Dual-Duct Cycle of Fig. 1

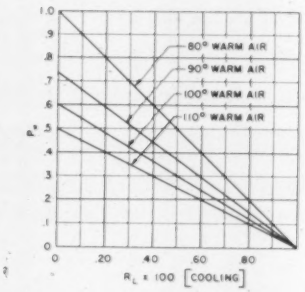
Control of the dry-bulb temperature in individual zones is accomplished by room thermostats located in the conditioned spaces. Adequate control of all spaces can be obtained if the temperatures in cold and warm duct are maintained at the proper level and if the total plant capacity is balanced against the imposed loads.

On comfort multi-zone installations, close control of relative humidities is not essential and is never attempted. The principal concern is to avoid excessive humidities by restricting humidity variations to a narrow range resulting in approximately a 1 to 1½ deg variation in effective temperature. The range of 40 to 50 percent in relative humidity has been found adequate for summer operation.

To determine zone humidity level it is necessary always to determine, first, the humidity level in the average zone (represented by the state of the return air) and then, second, the state of the air in individual zones can be calculated. The *no-load* zone indicates maximum variation in relative humidities, and should be used as a criterion to determine the applicability of a particular dual-duct cycle for a given set of conditions.

Nomenclature

G_x = moisture content of average room air, grains per pound.
G_z = moisture content of *no-load* zone air, grains per pound.
G_c = moisture content of cold supply air, grains per pound.
G_o = moisture content of outside air, grains per pound.
G_r = room latent load, grains per pound of air circulated.
G_w = moisture content of warm air, grains per pound.
P_o = ratio of outside to total air.
P_w = ratio of warm to total air $= (1 - R_{LI})\ \{(t_r - t_c)/(t_w - t_c)\}$, for $t_r = 80$ F and $t_c = 50$ F; this equation is represented as follows for various warm air temperatures.



R_{LI} = percentage of total internal sensible heat load divided by 100.
t_r = dry-bulb temperature of room air.
t_c = dry-bulb temperature of cold air.
t_w = dry-bulb temperature of warm air.
H_s = total internal sensible heat load on a system during summer or winter peak, Btu per hour.
H_s^1 = internal sensible heat load of a particular zone during summer or winter peak, Btu per hour.
Q = total air handled by the supply fan, cubic feet per minute.
Q_c = total cold air required by the system during summer or winter peak, cubic feet per minute.
Q_w = total warm air required by the system during summer or winter peak, cubic feet per minute.
Q_c^1, Q_c^2, etc. = cold air required in a particular zone for summer peak, assuming that the zone receives cold air only, cubic feet per minute.
Q_w^1, Q_w^2, etc. = warm air required in a particular zone for winter peak, assuming that the zone receives warm air only, cubic feet per minute.
Q_o^1, Q_o^2, etc. = outdoor ventilating air required in a particular zone, cubic feet per minute.
Q_v^1, Q_v^2, etc. = total air required by a particular zone to satisfy ventilating conditions, cubic feet per minute.

In Fig. 4 for a given sensible-to-total-heat ratio the average room conditions could be represented by point 1. Point 2 represents the *no-load* zone conditions, while average conditions shown by point 1 exist in the return duct. Point 2 is at the intersection of line 8-6 and the room dry-bulb temperature. On high

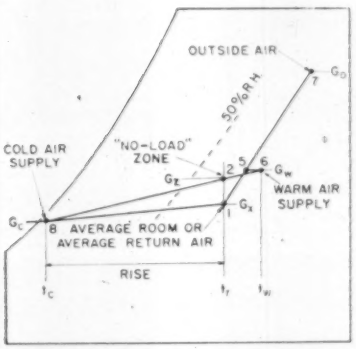


Fig. 4—Psychrometric chart representation of the dual-duct system of Fig. 1
Operating on summer peak load (100 percent internal sensible and latent heat loads) 25 percent outside air.

pressure systems the heat of compression added to the air by the supply fan is represented by the distance 5-6.

In Fig. 5 the *no-load* zone is again determined by the intersection of line 6-8 and the dry-bulb temperature. Average room condition 3 is obtained by heating the theoretical average mixture of cold and warm air along a new, higher, sensible-to-total-heat-ratio line.

From Figs. 4 and 5 it is apparent that when this system is operating under partial load conditions, the moisture content of the average room air and the *no-load* zone air is higher than under 100 percent load operation. If examination of the cycle on the psychrometric chart were continued by changing conditions one by one and noting the effect produced, it would be seen that room conditions are affected by many other factors in addition to the internal sensible heat illustrated on Figs. 4 and 5.

The factors affecting both the average room conditions and conditions in the *no-load* zone are:

(*a*) Specific humidity of outside air (G_o);
(*b*) Percentage of outside air drawn into the system (P_o);
(*c*) Specific humidity of cold supply air (G_c);
(*d*) Internal latent heat gains (G_R);
(*e*) Percentage of the warm air (P_w);
(*f*) Dry bulb temperature of the warm air (t_w).

To show actual performance of this dual-duct cycle it is necessary to find a general equation to show the combined effect of all the pertinent factors. Considering only a few of the factors involved could greatly distort the result and not show the true behavior of the cycle. The expression showing the interdependence of all factors affecting the state of the average room air is shown by Equation 1*:

$$G_x = [G_c (1 - P_w) + G_o (P_w - P_o) + G_R]/\{1 - [P_w (1 - P_o)]\} \quad \ldots\ldots\ldots\ldots\ldots (1)$$

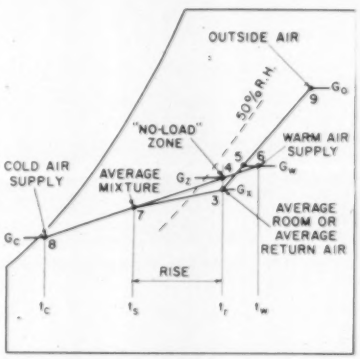


Fig. 5—Same as Fig. 4 but with 50 percent internal sensible heat load

A like expression for the state of the *no-load* zone is given by Equation 2:

$$G_z = G_c + [G_x - G_c + (G_o - G_x) P_o] [(t_r - t_c)/(t_w - t_c)] \quad (2)$$

The general algebraic forms of these equations is greatly simplified when used for any particular set of conditions and plotted in convenient graphical form. For example, assume it is desired to investigate the behavior of a system with the following set of conditions:

1. Design outside air conditions, 95 F db and 75 F wb, outside air 25 percent of total (G_o = 98 grains, P_o = 0.25);
2. Room 80 F db (t_r = 80 F);
3. Supply air 50 F db and 49.5 F wb (G_c = 51);
4. Initial sensible heat to total heat ratio (SH/TH) = 0.9 (G_R = 5 grains per lb of air handled)

Then, Equation 1 becomes:

$$G_x = 35.3 [(2.11 - P_w)/(1.33 - P_w)] \quad \ldots\ldots\ldots\ldots\ldots (1a)$$

and Equation 2 reduces to:

$$G_z = 29 + (0.625) G_x \quad \ldots\ldots\ldots (2a)$$

Graphical representation of Equation 1*a* is indicated by curves A, B, C, D, and E on Fig. 6, and shows resulting conditions of average room air through the entire range of the cycle, for various arbitrary warm air temperatures. These curves show at a glance the effect of the warm air temperatures on the resulting average room conditions. The effect is relatively small while the system is operating at high loads and is very pronounced when the internal sensible load on a system falls to a lower level. This fact immediately gives a clue as to how this system can be controlled to prevent rise of humidity in the conditioned spaces. Various methods of control are possible depending on the medium of heat available and the degree of precision of control of relative humidities desired. As an extreme case, which would result in least variation in the state of the room air, the system could be operated from, say, 100 to 70 percent load at any warm air temperature, say 86 F, allowing a slight rise in room relative humidity, as shown by curve B. At 70 percent load, heat could be applied to the warm air coil raising its temperature to, say, 110 F. This shifts operation from curve B. At 70 percent load, heat tions of humidities in the room air to a minimum. This method might be feasible and economical when an inexpensive source of reheat is available, such as the hot gas of the refrigerating machine.

On large comfort installations, the following method is suggested. Al-

*Derivations of Equations, 1, 2, 1a, 2a, 1b, 2b, 2c, 2d, 3, 4, and 5 are all shown in the Appendix.

low the system to operate without external reheat on a curve such as

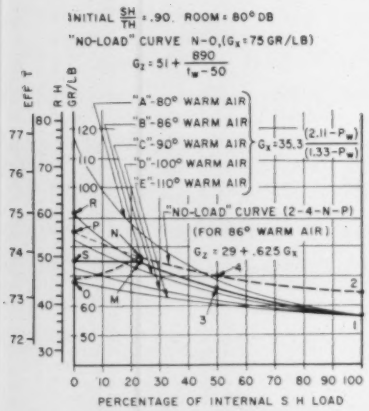

INITIAL SH/TH = .90. ROOM = 80° DB
"NO-LOAD" CURVE N-O, (G_x = 75 GR/LB)
$G_z = 51 + \frac{890}{t_w - 50}$
EFF T
R H
GR/LB
"A"-80° WARM AIR
"B"-86° WARM AIR
"C"-90° WARM AIR
"D"-100° WARM AIR
"E"-110° WARM AIR
$G_x = 35.3 \frac{(2.11 - P_w)}{(1.33 - P_w)}$
"NO-LOAD" CURVE (2-4-N-P)
(FOR 86° WARM AIR)
$G_z = 29 + .625\,G_x$
PERCENTAGE OF INTERNAL S H LOAD

Fig. 6—Performance over whole range of internal sensible heat load of dual-duct system of Fig. 1

With 25 percent outside air at 95 F dry-bulb, 75 F wet-bulb, 98 grains per lb; cold air at 50 F dry-bulb, 49.5 F wet-bulb, 51 grains per lb; at various warm air temperatures.

E up to a point such as M. At that point, apply reheat gradually to the

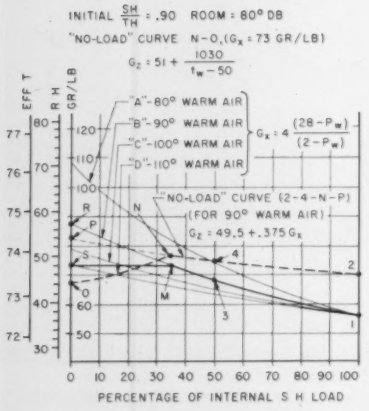

INITIAL SH/TH = .90 ROOM = 80° DB
"NO-LOAD" CURVE N-O, (G_x = 73 GR/LB)
$G_z = 51 + \frac{1030}{t_w - 50}$
EFF T
R H
GR/LB
"A"-80° WARM AIR
"B"-90° WARM AIR
"C"-100° WARM AIR
"D"-110° WARM AIR
$G_x = 4 \frac{(28 - P_w)}{(2 - P_w)}$
"NO-LOAD" CURVE (2-4-N-P)
(FOR 90° WARM AIR)
$G_z = 49.5 + .375\,G_x$
PERCENTAGE OF INTERNAL S H LOAD

Fig. 7—Same as Fig. 6, but 50 percent of outside air

warm air heating coil, which can be accomplished by installing a humidistat in the return duct to control steam flow to the heating coil and, in this manner, limit the rise in average room conditions as indicated by line M-S. While the system as a whole operates on line 1-3-M the conditions in the *no-load* zone could be calculated from Equation 2*a* and shown by curve 2-4-N. From point M down, Equation 2 can be modified as shown in the Appendix and *no-load* zone for constant G_x can be expressed by Equation 2-B:

$$G_z = 51 + [890/(t_w - 50)] \quad ..(2b)$$

The Equation 2*b* is represented by curve N-O in Fig. 6.

A similar method of representing the performance of a cycle is applied to a system which draws 50 percent outside air, as shown on Fig. 7. It will be noticed that the system handling 50 percent outside air, in order to prevent rise of relative humidities in the *no-load* zone above 50 percent RH (relative humidity) level, requires a greater amount of reheat than that shown on Fig. 6.

All curves in Figs. 6 and 7 are drawn with the assumption that the outside air dew point temperature remains at its summer design level while the system operates through its entire range. Under these conditions, the curves of Figs. 6 and 7 show maximum possible theoretical variation in the state of room air for the cycle of Fig. 1. In actual operation the lower internal sensible heat conditions coincide with lower outside air dew point temperatures and the actual operating curves are flatter than those shown in Figs. 6 and 7.

In order to test the applicability of the cycle of Fig. 1 to a given set of conditions, it is sufficient in most cases to plot only two curves, one for average air and one for the *no-load* zone, and then, to determine the point of application of reheat, such as point N on Fig. 6. It is suggested that use of the cycle of Fig. 1 be restricted to conditions when point N falls in the 0 to 40 percent range of internal sensible heat. If a given set of design conditions demanded application of reheat while the system was operating at high load, that would be an indication that the conditions would be better met by a cycle such as shown on Figs. 2 or 3.

Performance of Dual-Duct Cycle of Fig. 2

The adverse effect on room conditions of the introduction of large

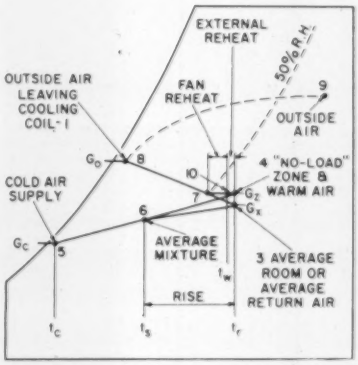


Fig. 8—Psychrometric chart representation of dual-duct system of Fig. 2 — summer cycle — 25 percent outside air — 50 percent internal heat load

quantities of outdoor air at high dew point temperature into air conditioning apparatus can be greatly minimized by the application of the dual-duct cycle of Fig. 2. By installing a cooling coil in the minimum outside air intake the moisture content of the

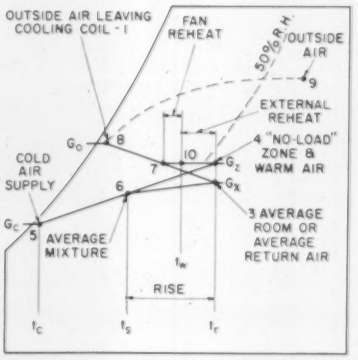


Fig. 9—Same cycle as in Fig. 8 but with 50 percent outside air

outdoor air can be reduced to any desired level and the rise of humidities in the conditioned spaces can be restricted on falling loads. However, if the outdoor air is precooled excessively, it may be necessary to apply

external reheat to the air in the warm duct even at high loads in order not to overcool lightly loaded zones. Fortunately, on a majority of comfort installations, when the system as a whole, operates at high loads,

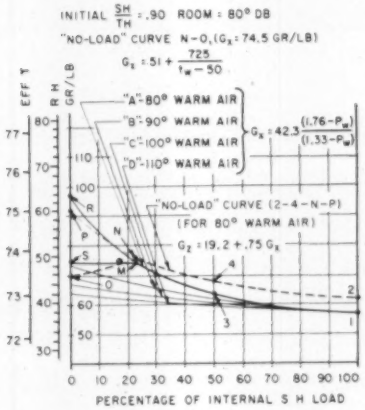

INITIAL SH/TH = .90 ROOM = 80° DB
"NO-LOAD" CURVE N-O, (G_x = 74.5 GR/LB)
$G_z = 51 + \frac{725}{t_w - 50}$
"A"-80° WARM AIR
"B"-90° WARM AIR
"C"-100° WARM AIR
"D"-110° WARM AIR
$G_x = 42.3\frac{(1.76 - P_w)}{(1.33 - P_w)}$
"NO-LOAD" CURVE (2-4-N-P)
(FOR 80° WARM AIR)
$G_z = 19.2 + .75\,G_x$
EFF T
R H
GR/LB
PERCENTAGE OF INTERNAL S H LOAD

Fig. 10—Performance over whole range of internal sensible heat load of dual-duct system of Fig. 2

With 25 percent outside air; air leaving Coil No. 1 at 61 F dry-bulb, 59.5 dew-point, 77 grains per lb; cold air at 50 F dry-bulb, 49.5 F wet-bulb, 51 grains per lb; at various warm air temperatures

all zones require some cooling, and partial cooling by *warm* duct is not objectionable.

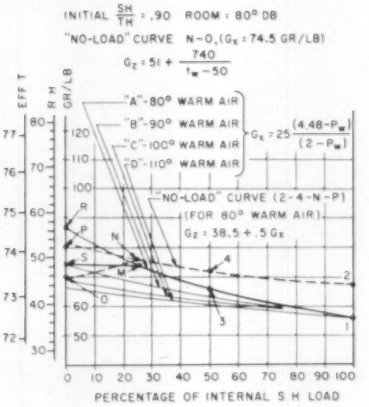

INITIAL SH/TH = .90 ROOM = 80° DB
"NO-LOAD" CURVE N-O, (G_x = 74.5 GR/LB)
$G_z = 51 + \frac{740}{t_w - 50}$
"A"-80° WARM AIR
"B"-90° WARM AIR
"C"-100° WARM AIR
"D"-110° WARM AIR
$G_x = 25\frac{(4.48 - P_w)}{(2 - P_w)}$
"NO-LOAD" CURVE (2-4-N-P)
(FOR 80° WARM AIR)
$G_z = 38.5 + .5\,G_x$
EFF T
R H
GR/LB
PERCENTAGE OF INTERNAL S H LOAD

Fig. 11—Same as Fig. 10 with 50 percent of outside air

In Fig. 8 it is assumed that the outdoor air is precooled to a point such as 8. On high pressure systems the mixture of outdoor and return air is reheated by the supply fan to a condition shown by point 10. Additional external reheat as represented by 10-4, is necessary if *no-load* zones are to be satisfied. The average room conditions as shown by point 3 are determined by heating the average mixture of cold and warm air along corresponding average sensible-to-total-heat ratio as shown by line 6-3. Both *no-load* zone and conditions in the warm duct are represented by point 4.

Performance of the cycle through its entire operating range can be represented again by the general dual-duct Equations 1 and 2 if the meaning of term G_o is changed to represent the moisture content of air leaving coil No. 1. The operation of such a system through its entire range under a stated set of conditions is shown on Fig. 10. Curves A, B, C and D representing the state of the air in the average room are plotted from:

$$G_x = 42.3\,[(1.76 - P_w)/(1.33 - P_w)]. \quad \ldots\ldots\ldots\ldots\ldots\ldots (1b)$$

The *no-load* zone curve 2-4-N-P for 80 F warm air is shown by:

$$G_z = 19.2 + (0.75)\,G_x \quad \ldots\ldots\ldots (2c)$$

The *no-load* curve N-O for constant G_x = 74.5 grains per lb is represented by:

$$G_z = 51 + [725/(t_w - 50)] \quad \ldots (2d)$$

Operation of this cycle on comfort installations is similar to that of the cycle of Fig. 1. Assuming that warm air is maintained at 80F the average room conditions are allowed to rise as shown by curve A up to point M. When the humidity has risen to point M, reheat under control of the humidistat is gradually applied to the warm duct, thus keeping the average room conditions constant (line MS). If the system is controlled in this manner the state of air in *no-load* zones is limited to conditions shown by curves 2-4-N-O.

The conditions obtainable when operating the same system but with 50 percent of outside air are shown on Figs. 9 and 11.

Performance of Dual-Duct Cycle of Fig. 3

On Fig. 12 Curves A, B, C, D and E show the effect of variation of warm air temperatures on the average room conditions while the system is operating under conditions specified. At high internal loads the

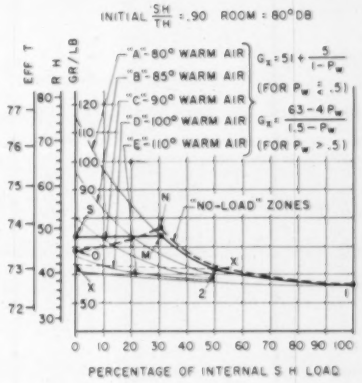

INITIAL SH/TH = .90 ROOM = 80° DB
"A"-80° WARM AIR
"B"-85° WARM AIR
"C"-90° WARM AIR
"D"-100° WARM AIR
"E"-110° WARM AIR
$G_x = 51 + \frac{5}{1 - P_w}$ (FOR $P_w \leq .5$)
$G_x = \frac{63 - 4\,P_w}{1.5 - P_w}$ (FOR $P_w > .5$)
"NO-LOAD" ZONES
EFF T
R H
GR/LB
PERCENTAGE OF INTERNAL S H LOAD

Fig. 12—Performance over whole range of internal sensible heat load of dual-duct system of Fig. 3

With 25 percent outside air at 95 F dry-bulb, 75 F wet-bulb, 98 grains per lb; cold air at 50 F dry-bulb, 49.5 F wet-bulb, 51 grains per lb; at various warm air temperatures

warm duct handles only return air and the system is thermodynamically equivalent to a single-duct system with face and bypass dampers where

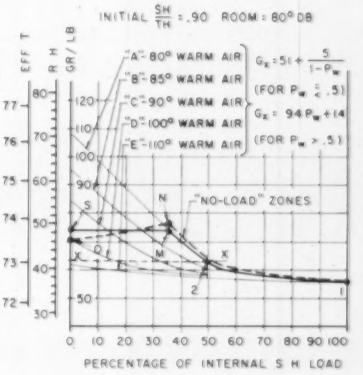

INITIAL SH/TH = .90 ROOM = 80° DB
"A"-80° WARM AIR
"B"-85° WARM AIR
"C"-90° WARM AIR
"D"-100° WARM AIR
"E"-110° WARM AIR
$G_x = 51 + \frac{5}{1 - P_w}$ (FOR $P_w \leq .5$)
$G_x = 94\,P_w + 14$ (FOR $P_w > .5$)
"NO-LOAD" ZONES
EFF T
R H
GR/LB
PERCENTAGE OF INTERNAL S H LOAD

Fig. 13—Same as Fig. 12 with 50 percent of outside air

only return air is bypassed around the dehumidifying equipment. At 100 percent load, average room conditions are represented by point 1. All curves from point 1 up to the intersection with line X-X show a

gradual rise in humidities and can be expressed by the equation:

$$G_x = 51 + [5/(1 - P_w)] \quad \ldots\ldots(3)$$

During this part of the operation the *no-load* zone conditions coincide with average room conditions.

On falling loads when demand for warm air exceeds that of cold air some outdoor air is admitted directly into the warm duct and the performance of this cycle resembles more and more that of the cycle of Fig. 1. The part of performance curves above the line X-X can be represented by equation:

$$G_x = (63 - 4P_w)/(1.5 - P_w) \quad \ldots(4)$$

It is apparent that, even with this system, reheat must be applied to the warm duct if it is desired to restrict the rise of humidities at low internal loads while high humidity prevails outdoors.

Operating on curve A of Fig. 12 the humidity might be allowed to rise to point M and then reheat would be applied to the warm duct in the manner described for Figs. 1 and 2. Gradually increasing the warm air temperature would keep the average room conditions on the humidity level of line MS. For a system operated in this manner, the *no-load* zone conditions are represented by curves 1-2-N-O.

Fig. 13 shows the performance of the same system handling 50 percent outside air. As shown in the Appendix, Equation 3 is applicable to the temperature curves as is also the equation:

$$G_x = 94\ P_w + 14 \quad \ldots\ldots\ldots\ldots(5)$$

Pressure and Air Volume Variations

A problem in applying the dual-duct system to large multi-room installations is the operating control of static pressures and volumetric delivery in the distributing system. Due to the nature of the dual-duct system, the diurnal and seasonal variations of internal loads produce constantly changing demands for cold and warm air, thus continuously changing the rate of flow through the dual sides of the distributing system. This change, in turn, causes a wide variance in static pressures in the ducts and upsets the initial volumetric setting of individual outlets serving a particular area. In all cases the range of pressure and air volume variations reaches a maximum at the end

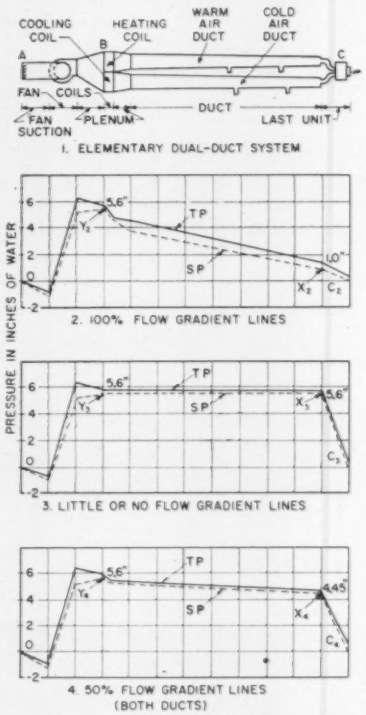


Fig. 14—Energy gradients for dual-duct system with various air flows

of the run on the last few outlets. Even on smaller systems operating at, say, 2½ in. static pressure on the supply fan, it is possible to have fluctuation of pressures on the last outlet between, say, ½ to 1 in. of water which will cause a change of

$$42 \text{ percent} = \left[\left(\sqrt{\frac{1}{0.5}} - 1\right) \times 100\right]$$

in volumetric delivery to the room being served by the outlet. On larger systems operating, say, at 6-7 in. of static pressure on the supply fan, the static pressure at last outlet might vary between 1 to 4 in. of water changing the rate of air flow into the conditioned space.

$$100 \text{ percent} = \left[\left(\sqrt{\frac{4}{1}} - 1\right) \times 100\right]$$

Variation in air volume of such magnitude may result in a noisy outlet, in faulty air distribution, and in a changed relationship of the controlled room dry-bulb temperature to effective temperature.

The basic problem of pressure and volume control can be illustrated by Fig. 14. There the various gradient lines indicate the total and static pressures existing in the elementary system shown at the top. These gradient lines have been plotted for arbitrarily assumed flow in one duct, the total flow remaining constant; namely 100 percent, 50 percent and no flow in either the cold or warm duct.

It is impossible to maintain a constant volume of air flowing through the system with static pressure regulators at the fan or at the entrance to the supply mains. It is assumed, therefore, that the system is equipped with volume regulators placed at each mixing or attenuating unit. This method maintains constant flow to each outlet and consequently constant total fan cfm. Fig. 14 shows the pressure changes occurring throughout the system under normal automatic control and indicates the variations in flow which might occur without effective volume regulation at the various outlets. Figs. 14-2 and 14-3 represent the pressures in each duct when all air flow is through one duct, a condition approached while the system is operating during summer or winter peak or just after a start-up. These pressures reverse in the two ducts when controls shift from cooling to heating or from heating to cooling.

In Fig. 14-2 the last unit is designed for rated cfm at 1 in. static pressure, the duct and coils being designed for 4.6 in. pressure drop (5.6 − 4.6 = 1). If all units, except the last, call for heating and the last unit calls for cooling, the pressure on the last unit will rise to the condition on Fig. 14-3, or 5.6 in. Without effective volume regulation, this last unit would then discharge approximately 236 percent of rated cfm.

If the demand for warm and cold air is equal, the condition of Fig. 14-4 exists. The pressure drop in the duct and coils is now 25 percent = $[(50/100)^2 \times 100]$ and the pressure at the last unit is $[5.6 - (0.25 \times 4.6)] = 4.45$ in. The last unit would then deliver

$$\left(\sqrt{\frac{4.45}{1}} \times 100\right) = 210 \text{ percent}$$

of design cfm.

Without volume control these pressure changes would be different, due to increased flow at the terminal units and to the limits of the fan.

This basic variation in the dual-duct system may be controlled by volume controllers installed as an integral part of each dual-duct mixing unit, which not only keep the air quantity substantially constant in any particular zone, but also maintain a fixed rate of air flow in the entire system, thus preventing fluctuations in power input to the supply fan motor.

Elements of Design

The design procedure for a dual-duct system does not differ greatly from the procedure employed in the design of any other multi-room project. The basic principles, procedure and standards are amply presented in ASHAE publications and should be adhered to as closely as possible. In addition, all accepted codes and practices of recognized groups should be incorporated in the design of component parts. However, certain steps in design procedure, as listed here, differ slightly from the established procedure employed in the design of single-duct systems and should be taken into consideration.

1. Since all zones of a dual-duct system handle a substantially constant amount of air at all times, the air requirements for each zone should be checked for demands of summer and winter peaks and for ventilating requirements, and the highest value is used for the zone cfm. Equations 6, 7, and 8 can be used to establish these demands.

$$Q_c^1 = H_s^1/(t_r - t_c)\ 1.08 \quad \ldots\ldots\ldots(6)$$

$$Q_w^1 = H_s^1/(t_w - t_r)\ 1.08 \quad \ldots\ldots\ldots(7)$$

$$Q_v^1 = Q_o^1/P_o \quad \ldots\ldots\ldots(8)$$

2. Total air quantity handled by a supply fan must be equal to the sum of peaks of all zones (as determined by Equations 6, 7 or 8)

$$Q = Q_c^1 + Q_c^2 + \ldots\ldots + Q_w^{10} + Q_w^{11} + \ldots\ldots + Q_v^{(n-1)} + Q_v^n \quad \ldots\ldots\ldots(9)^*$$

From Equation 9 it is evident that the total air supply of a large dual-duct system consisting of many zones always exceeds the cold air quantity flowing in the cold duct, even during the summer peak. Similarly during the winter peak the total air quantity is greater than that needed in the warm duct.

3. The quantities of cold and warm air required in a system during summer peak must be determined from Equations 10 and 11.

$$Q = Q_c + Q_w \quad \ldots\ldots\ldots(10)$$

$$H_s + Q_w\ (t_w - t_r)\ 1.08 = Q_c\ (t_r - t_c)\ 1.08 \quad \ldots\ldots\ldots(11)$$

At first glance it might appear that the second term of Equation 11 represents a system penalty on the refrigerating machine. Actually, this is not the case. During summer high load operation no external source of reheat is required in the warm duct and thus the sensible heat being bypassed in the warm duct consists only of the component loads of the system which heat must be removed by the refrigerating system irrespective of the manner in which it is handled. For the cycle of Fig. 1 the second term of Equation 11 consists of the heat of compression of the supply fan as applied to the air flowing in the warm duct plus *outside air reheat* of the portion of outside air being bypassed through the warm duct.

4. The quantities of cold and warm air required in a system during winter peak must be determined from Equations 10 and 12.

$$H_s + Q_c\ (t_r - t_c)\ 1.08 = Q_w\ (t_w - t_r)\ 1.08 \quad \ldots\ldots\ldots(12)$$

*Subscripts in Equation 9 refer to arbitrary zone numbers.

The second term of Equation 12, again is not a system penalty, provided no refrigeration or evaporative cooling is applied to the air flowing in the cold duct during high load operation. The last term of Equation 12 represents the sensible heat load to be added to the heating coil in the warm duct on peak winter load.

5. The dry-bulb temperatures in cold and warm ducts should be maintained at a level such that at any time it is possible to satisfy the internal sensible loads of the two most dissimilar zones with air volumes as fixed by design conditions. Evidently that can be accomplished by an innumerable set of temperature conditions in the cold and warm ducts. In actual design practice the selection of these temperature levels is governed by practical considerations rather than by detailed and theoretical analysis.

During the entire summer cycle the cold air temperature is maintained constant, being selected from the 50 to 55 deg range. For the cycle of Fig. 1, the 50 to 53 deg range is preferable. During winter operation if no deep interior zones were connected to the system, the cold air temperature could be raised by 5 to 15 deg.

The warm air temperature normally is subject to a greater variation than the cold air. In summer during high load operation the warm air temperature as a rule is not controlled and may fluctuate in the 78 to 90 deg range. When the system begins operating at low partial loads, reheat might be added to the warm duct coil raising its temperature to say 95 to 105 deg. For winter operation at peak load the warm air temperature might be selected in the 120 to 140 deg range and, if desired, reduced to a lower level on falling load by an outside air reset thermostat.

APPENDIX

Derivation of Equation 1: Fig. A-1 shows, algebraically, the latent heat conditions existing in a dual-duct apparatus and in the conditioned space.

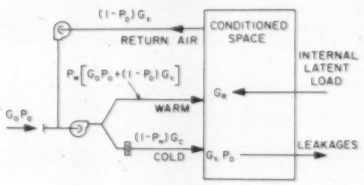


Fig. A-1—Latent heat balance, dual-duct system of Fig. 1

On Fig. A-2 the same conditions are indicated for an analogous single-duct system.

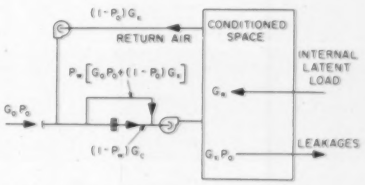


Fig. A-2—Latent heat balance, single-duct system of Fig. 1

The latent heat flowing into the conditioned space should be equal to that flowing out of the space, or:

$$(1 - P_w)\ G_c + P_w\ [G_oP_o + (1 - P_o)\ G_r] + G_R = G_rP_o + (1 - P_o)\ G_r$$

or rearranging:

$$G_r = [G_c\ (1 - P_w) + G_o\ (P_wP_o) + G_R]/\{1 - [P_w\ (1 - P_o)]\},$$

which is Equation 1.

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Derivation of Equation 2: Referring to Fig. 5, from the geometry of the cycle it can be written:

$$G_w = G_x + (G_o - G_x)\, P_o$$
$$G_x = G_c + [(G_w - G_c)\ (t_r - t_c)]/(t_w - t_c)$$

combining and rearranging:

$$G_x = G_c + [G_x - G_c + P_o\ (G_o - G_x)]\ [(t_r - t_c)/(t_w - t_c)],$$

which is Equation 2.

Derivation of Equation 1a: For: $P_o = 0.25$; $G_c = 51$ grains per lb; $G_R = 5$ grains per lb; and $G_o = 98$ grains per lb; Equation 1 can be written:

$$G_x = [51\ (1 - P_w) + 98\ (0.25\ P_w) + 5]/[1 - P_w\ (1 - 0.25)]$$

solving and rearranging:

$$G_x = 35.3\ [(2.11 - P_w)/(1.33 - P_w)],$$

which is Equation 1a.

Derivation of Equation 2a: For: $P_o = 0.25$; $G_c = 51$ grains per lb; $G_o = 98$ grains per lb; $t_w = 86$ F; $t_r = 80$ F; and $t_c = 50$ F; Equation 2 can be written:

$$G_x = 51 + [G_x - 51 + 0.25\ (98 - G_x)]\ [(80 - 50)/(86 - 50)]$$

solving and rearranging:

$$G_x = 29 + 0.625\ G_x,$$

which is Equation 2a.

Derivation of Equation 2b: For: $G_x = 75$ grains per lb; $P_o = 0.25$; $G_c = 51$ grains per lb; $G_o = 98$ grains per lb; $t_r = 80$ F; $t_c = 50$ F; Equation 2 can be written:

$$G_x = 51 + [75 - 51 + 0.25\ (98 - 75)]\ [(80 - 50)/(t_w - 50)]$$

solving and rearranging:

$$G_x = 51 + [890/(t_w - 50)],$$

which is Equation 2b.

Derivation of Equation 1b: For: $G_o = 77$ grains per lb; $G_c = 51$ grains per lb; $P_o = 0.25$; and $G_R = 5$; Equation 1 can be written:

$$G_x = [51\ (1 - P_w) + 77\ (0.25)\ P_w + 5]/\{1 - [P_w\ (1 - 0.25)]\}$$

solving and rearranging:

$$G_x = 42.3\ [(1.76 - P_w)/(1.33 - P_w)],$$

which is Equation 1b.

Derivation of Equation 2c: For: $G_o = 77$ grains per lb; $G_c = 51$ grains per lb; $P_o = 0.25$; $G_R = 5$; $t_r = 80$ F; $t_c = 50$ F; $t_w = 80$ F; Equation 2 can be written:

$$G_x = 51 + [G_x - 51 + 0.25\ (77 - G_x)]\ [(80 - 50)/(80 - 50)]$$

solving and rearranging:

$$G_x = 19.2 + 0.75\ G_x,$$

which is Equation 2c.

Derivation of Equation 2d: For: $G_o = 77$ grains per lb; $G_c = 51$ grains per lb; $P_o = 0.25$; $G_R = 5$; $t_r = 80$ F; $t_c = 50$ F; and $G_x = 74.5$ grains per lb; Equation 2 can be written:

$$G_x = 51 + [74.5 - 51 + 0.25\ (77 - 74.5)]\ [(80 - 50)/(t_w - 50)]$$

solving and rearranging:

$$G_x = 51 + [725/(t_w - 50)],$$

which is Equation 2d.

Derivation of Special Equations for Cycle of Fig. 3, Case I: 25 percent outside air, no direct flow of outside air into warm duct (when $P_w \gtrless 0.5$)

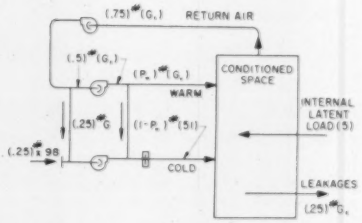

Fig. A-3—Latent heat balance, dual-duct system of Fig. 3, Case I

Latent heat flowing into conditioned space equals latent heat flowing out of conditioned space

$$P_w G_x + (1 - P_w)\ 51 + 5 = 0.25\ G_x + 0.75\ G_x$$

and rearranging

$$G_x = 51 + [5/(1 - P_w)],$$ which is Equation 3.

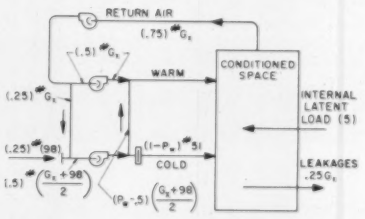

Fig. A-4—Latent heat balance, dual-duct system of Fig. 3, Case II

Case II: 25 percent outside air, direct flow of outside air into warm duct (when $P_w > 0.5$)

$$51\ (1 - P_w) + (P_w - 0.5)\ [(G_x + 98)/2] + 0.5\ G_x + 5 = 0.25\ G_x + 0.75\ G_x$$

and rearranging

$$G_x = [(63 - 4\ P_w)/(1.5 - P_w)],$$

which is Equation 4.

Case III: 50 percent outside air, no direct flow of outside air into warm duct (when $P_w \gtrless 0.5$)

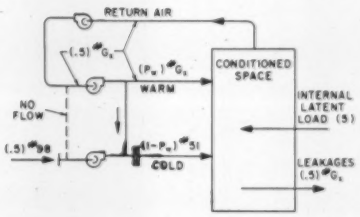

Fig. A-5—Latent heat balance, dual-duct system of Fig. 3, Case III

$$P_w G_x + (1 - P_w)\ 51 + 5 = 0.5\ G_x + 0.5\ G_x$$

and rearranging

$$G_x = 51 + [5/(1 - P_w)] \quad \ldots.(3)$$

(same as for 25 percent outside air system).

Case IV: 50 percent outside air, direct flow of outside air into warm duct (when $P_w > 0.5$)

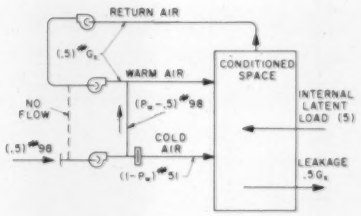

Fig. A-6—Latent heat balance, dual-duct system of Fig. 3, Case IV

$$0.5\ G_x + (P_w - 0.5)\ 98 + (1 - P_w)\ 51 + 5 = 0.5\ G_x + 0.5\ G_x$$

and rearranging

$$G_x = 94\ P_w + 14,$$ which is Equation 5.

Body Evaporation During Short Exposures to Various Temperatures, Humidities, Pressures and Mass Velocities†

By J. W. McCutchan*, Los Angeles, Calif.

SUMMARY — Two subjects were exposed separately in a small steel cylinder for a 25-min period to an environment where temperature, humidity, pressure and mass velocity were controlled. This is an example of an economical method of designing a physiological experiment, using the *Latin Squares*. An empirical equation is derived which can be used to estimate the evaporative water loss from the nude human body as a function of the environmental variables, within the stated range. Fifty experiments on two healthy young men show that temperature is by far the most significant of the several environmental variables.

IT IS KNOWN that the human body's defense for high thermal stress is by increased perspiration and a limited amount of body temperature rise. This is quantitatively expressed by the first law of thermodynamics, which in symbolic form is: $Q - W = \triangle E$. The system is the human body (non-flow) and the boundary is the skin surface. Q is the heat transferred to the body; W, the work done by the body, and $\triangle E$, the change in internal energy. In applying this equation to the human body it is customary to separate the various modes of heat transfer, to assume $W = O$ and to call $\triangle E$ the heat storage, q_s.

Thus,

$$\underset{\text{radiation}}{q_r} + \underset{\text{convection}}{q_c} + \underset{\text{metabolism}}{q_m} + \underset{\text{evaporation}^{**}}{q_e} = \underset{\text{storage}}{q_s}$$

Blockley et al[1] give data for human time tolerance at extreme temperatures as a function of body storage. The engineer can compute this storage by subtracting the heat loss by evaporation from the heat gained by radiation, convection and metabolism (a design value for pilots' metabolism is 75 kilocalories per (square meter) (hour). The calculation of the radiation and convection terms is done basically from the environmental variables, so it would be convenient if evaporation were likewise expressed in these terms. The object of these experiments was to derive an empirical expression for W_e, the skin water loss by evaporation, as a function of environmental temperature, humidity, pressure and mass velocity. The product of this skin water loss and the heat of vaporization will then give q_e.

It was decided to run a series of 50 experiments in which five levels of temperature, water vapor pressure, pressure (altitude), mass velocity and time would be controlled and the subject's weight loss by evaporation determined as the dependent variable. The range of variables was as great as practical with the equipment at hand. Oxygen was given to the subject for altitudes above 8000 ft to avoid hypoxia and to confine the low barometric pressure effects to those acting upon thermal exchange.

Experimental Plans

The experimental schedule was based on 5 × 5 completely orthogonal squares making 25 experiments (Fig. 1). It was replicated once in order to determine the variance between subjects, making a total of 50 experiments. The independent variables of the environment were controlled at the specified settings. The principal dependent variable, weight loss, was measured by scale readings taken every five min. In addition, the dependent variables of skin temperature, rectal temperature, heart rate and estimated water accumulation on the body were also measured and recorded.

Varying pre-periods as a function of temperature were used in the experiments. This was based on previous data which indicated this amount of time was necessary to reach a quasi-steady state at the respective temperatures. Actually a variable pre-period is inherent in the design because of the time lag in attaining the altitude setting after the chamber door is closed. Only in the 37.8 C and 48.9 C experiments was any time spent in waiting for this pre-period to elapse.

Another point of note was that all exposure times lasted for 25 min so that the time variable could have been rotated to other combinations than those specified in Fig. 1. However, since a quasi-steady state was postulated, the time variable had no significant effect upon the slope of the curves, and the experimental design permitted checking this fact.

The order of experiments was arranged to keep Wednesday open for equipment repairs. Tests were run

†This paper is the result of research sponsored by Wright Air Development Center (Aero Medical Laboratory) in cooperation with the University of California, Los Angeles.

*Department of Engineering, University of California.

**Note sign convention of thermodynamics which says heat transferred to the body is plus, thus q_e is a negative term.

[1]Exponent numerals refer to References.

For presentation at the 62nd Annual Meeting of the AMERICAN SOCIETY OF HEATING AND AIR-CONDITIONING ENGINEERS, Cincinnati, Ohio, January 1956.

on Monday, Tuesday, Thursday and Friday, and no two high temperature experiments were run on successive days.

Subjects

The two subjects were normally healthy male college students. Before each experiment, which was always scheduled in the morning, the night's sleep, diet and sedentary activity were checked as being usual and normal. Twenty min of sitting-rest at room temperature preceded the chamber exposures, but otherwise, the conditions were non-basal. Subjects were nude except for shorts, flight helmet and moccasins.

A	A	B	A	C	A	D	A	E	A
	A		B		C		D		E
A	A	B	B	C	C	D	D	E	E
A	B	B	B	C	B	D	B	E	B
	E		A		B		C		D
B	C	C	D	D	E	E	A	A	B
A	C	B	C	C	C	D	C	E	C
	D		E		A		B		C
C	E	D	A	E	B	A	C	B	D
A	D	B	D	C	D	D	D	E	D
	C		D		E		A		B
D	B	E	C	A	D	B	E	C	A
A	E	B	E	C	E	D	E	E	E
	B		C		D		E		A
E	D	A	E	B	A	C	B	D	C

	PRE PERIOD	TIME MIN.	TEMP °C.	V P MM HG.	PRESS MM HG.	MASS VEL. KG/M² HR	CODE
KEY	20	5	37.8	10	750	966	A
TEMP V P	15	10	48.9	15	636	1022	B
TIME	10	15	60.0	20	522	1080	C
PRESS MASS V	8	20	71.1	25	409	1140	D
	6	25	82.2	30	295	1198	E

Fig. 1—Orthogonal squares experimental design

Methods and Equipment

Environmental Variables: The exposure chamber consisted of a one-man conditioned space with air temperature, air-movement, vapor pressure and ambient pressure control. The chamber is cylindrical in form, 70 in. long by 46 in. in diameter. The steel tank was lined with 6 in. of cork covered inside by galvanized iron painted with heat resistant, grey primer-surfacer. Equipment for evacuating the chamber to the equivalent of 40,000 ft altitude is located on the roof of the building.

Air movement through the chamber is controlled by a blower which can operate on an open circuit at sea level or on closed circuit when under vacuum. The air distribution system was designed to give reasonably uniform turbulence over the body. A series of tests was run in which air movements over the body were measured at a distance of 10 cm normal to the right shoulder, chest, lumbar, left elbow, right thigh, knee and left calf. The average of these readings was correlated with the flow-valve setting on the circulating blower, so that the mass flow was pre-set. This was done so that the subject had no duties during the run except to sit comfortably, thus giving more reliable scale readings.

Air temperature was controlled by a cycling type on-off controller, which is an electronic signaling device having a platinum resistance thermometer for a sensing element. Rapid recovery and inherent droop correction (an important factor after the door is opened) were the reasons for the choice of this particular equipment. Air and wall temperatures were sampled by parallel circuits of five distributed thermocouples and recorded by a potentiometer.

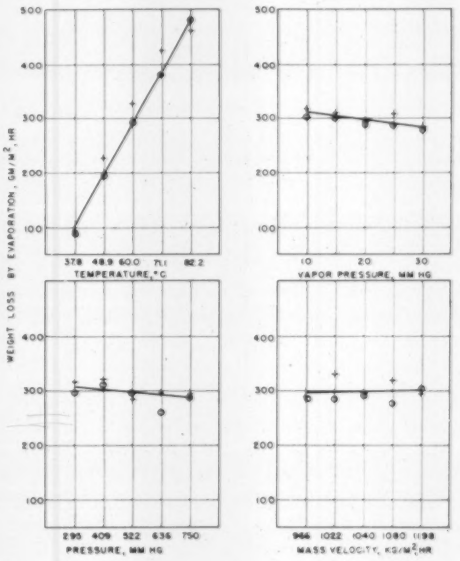

Fig. 2—Variation in weight loss by evaporation (each point is the average of five experiments)

Humidity was controlled by an electronic dew-point hygrometer connected to a pulsating on-off steam valve. Wet- and dry-bulb thermometers were used as a check. Low humidity was maintained by passing a portion of the chamber air through a silica-gel dryer.

Physiological Variables: Evaporative loss was determined by weighing the subject sitting upon one *pan* of a double-beam balance. Electrical remote control of balancing and subject stabilization between weighings is a unique feature of this balance

Table 1—Subject Characteristics

Subject	Symbol	Age (yrs)	Height (ft-in.)	Weight (lb)	Surface Area (ft^2)
E. H.	plus	24	5'11"	181	23
F. R.	circle	23	5'7"	152	20.6

Table 2—Percentage Variation

Average Values of	W_c	W_n	W_p	t_s	t_r	H.R.*
Temperature	97.4	65.7	97.0	75.0	56.3	89.4
Subject to Subject	0.5	2.2	0.5	0.1	5.0	2.3
Pressure	1.1	7.8	0.4	12.5	29.0	3.6
Vapor Pressure	0.2	18.5	1.2	9.5	2.7	1.8
Mass Velocity	0.5	2.2	0.4	1.7	5.2	1.6
Residual	0.3	3.6	0.5	1.6	1.8	1.3

*H.R. is heart rate in beats per minute.

system. The accuracy of the scales in simulated weight loss is ± 5 grams. In order to measure both perspiration and evaporation it was necessary to measure the water which dripped from the subject and the water stored on the skin. Therefore, at the beginning of each experiment two towels were weighed, one was placed in the seat, and at the end of the experiment the subject was wiped off with the second towel. The gain in weight of the two towels in addition to that of the shorts and cap represented the difference between perspiration and evaporation.

With thermocouples held firmly against the skin, skin temperatures were obtained at the right scapula, lower abdomen, right forearm, left thigh and right calf. Recording was made with a potentiometer with an accuracy of ± 0.25 C. The average of the five readings was designated the mean skin temperature. The rectal thermocouple was inserted to a depth of 10 cm and recorded on a precision potentiometer accurate to ± 0.05C. Heart rate was indicated on an electro-cardiotachometer.

Analysis of Results

The efficiency of this type of experimental design becomes apparent when the data are being reduced. To investigate the variation of weight loss with temperature, the data at each temperature level is used to obtain averages, which are plotted versus temperature. All other variables have their mean value, as for example 20 mm Hg humidity, 522 mm Hg pressure, and 1080 kg/m²hr mass velocity. The data are then sorted according to the levels of the other variables and plotted. It should be pointed out that this procedure assumes that interactions between variables are non-significant. This is generally a satisfactory assumption, but if strong interactions do exist, they will be indicated by a large residual variation[2].

Average data points are given for the dependent variables of weight loss by evaporation, Fig. 2; skin temperature, Fig. 3; and rectal temperature, Fig. 4. Averages of the other variables are reported in Table 2. It was apparent from the weight loss data that in the 25-min test period the weight loss rate, even

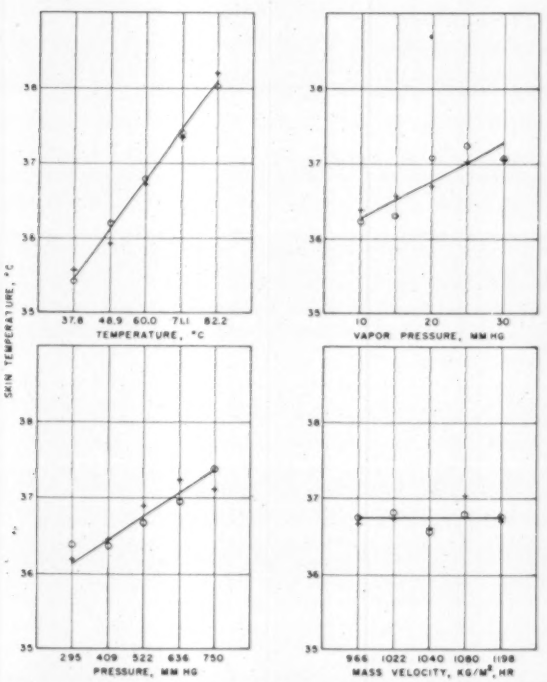

Fig. 3—Mean skin temperature (each point is the average of five experiments)

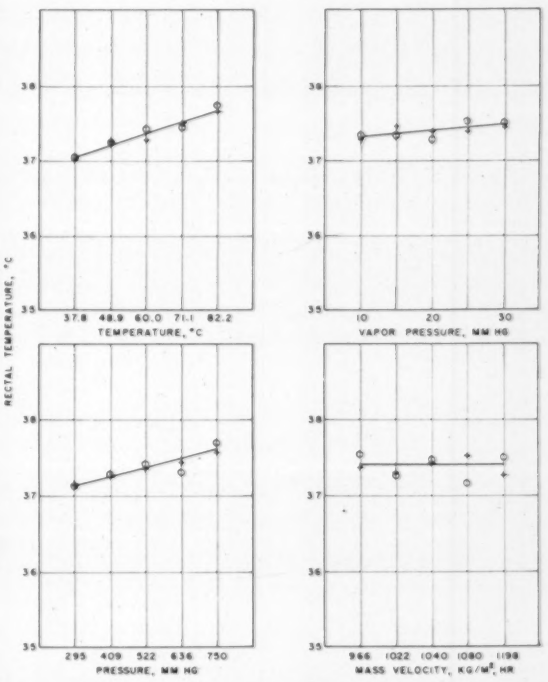

Fig. 4—Mean rectal temperature (each point is the average of five experiments)

NOMENCLATURE

D = characteristic dimension, meters.
D_m = diffusivity, square meters per hour.
G = mass velocity ($G = V\rho$), kilograms per (square meter) (hour).
K = vapor conductance, grams per (square meter) (hour) millimeters Hg.
p_a = vapor pressure of atmosphere, millimeters Hg.
P = barometric pressure, millimeters Hg.
R_e = Reynold's number (DG/μ), dimensionless.
t = air temperature, degrees centigrade.
t_r = rectal temperature, degrees centigrade.
t_s = mean skin temperature degrees centigrade.
V = velocity, meters per hour.
W_a = water accumulation on the skin, grams per (square meter) (hour).
W_e = evaporative water loss, grams per (square meter) (hour).
W_p = perspiration loss ($W_p = W_e + W_a$) grams per (square meter) (hour).
ρ = density, grams per cubic meter.
μ = viscosity, grams per (meter) (hour).
θ = time, minutes.
j_D = $(KP/G)\ (\mu/\rho\ D_m)^{0.67}$

though tending to increase with time, did not increase significantly, so an average weight loss rate for the 25-min period was used in reducing the data.

Figs. 2, 3 and 4 show the variations as functions of ambient air and wall temperature (which were always the same), water vapor pressure, pressure, and mass velocity. The lines are the *best fit* lines, and their slopes were taken to derive the following composite equations:

$$W_s = -150 + 8.70t - 2.09\,p_a - 0.079P + 0.0086G \quad (SE_{est}{}^* = \pm 35) \quad \ldots\ldots(1)$$

$$t_s = 24.73 + 0.607t + 0.052\,p_a + 0.003P \quad (SE_{est} = \pm 0.30) \quad \ldots(2)$$

$$t_r = 28.70 + 0.0135t + 0.0096\,p_a + 0.0016P \quad (SE_{est} = \pm 0.25) \quad \ldots(3)$$

Since t_s and t_r are definitely functions of time, a time analysis was run and the slopes determined as 0.0149 θ for t_s and 0.0216 θ for t_r, but since these average slopes for 60 C do not predict accurately for the extremes of temperature, they were not included in the equations.

The relative importance of the environmental temperature variable is impressive. Table 2 gives the percentage variation of the dependent variables attributed to the respective independent variables. In interpreting this table the range of the independent variables as specified in Fig. 1 must be kept in mind.

If the range in vapor pressure and mass velocity had been greater, it is probable that these variables would have had a greater influence on the results, but these were based on the limitations of the equipment at hand, and at least the range in pressure is pertinent to environmental designs. If the design problem involves a greater range of water vapor pressure, attention is called to the work of Winslow et al[3], and a greater range in velocity was investigated by Nelson et al[4].

*SE_{est} is the standard error of estimate, and is the range which contains two-thirds of the data points.

Discussion of Results

It is customary in the analysis of biophysical data to draw analogies with physical systems and to express the results in similar form. The data from the present study were compared to the evaporation from single spheres, single cylinders and flat surfaces as summarized by Maisel and Sherwood[5]. Plots using the analogy of the evaporation from the body with a wetted cylinder[6] and a plot of the water accumulation on the skin against Colburn j_D showed great scatter of the points. It is believed, therefore, that the equation given in the previous section provides a much closer estimate of evaporation from the human body in the specified range.

A question which still remains unanswered is: Why does the man subjected to heat stress appear so much better off at low ambient pressure? It has been suggested[7] that the evaporation rate increases, which in turn stimulates greater skin water loss which should result in greater weight loss due to evaporation as altitude increases. These data do not bear this out, at least not for a 25-min. exposure preceded by a preperiod of approximately 10 min. A suggested explanation is that it is the diffusion loss that is increased at low barometric pressure. This is without time lag so that the body temperature rise is slower and the rate of increase in sweat gland activity is diminished with the result that the body supplies about the same amount of water at an overall lower body temperature.

Conclusions

1. Over the ranges tested, with two healthy young men as subjects, environmental temperature has by far the most significant effect on skin water loss by evaporation.

2. The beneficial effect of reduced pressure on body temperature and hence the rate of heat storage is also significant.

3. Here is an example of an economical method of designing a physiological experiment, using the *Latin Squares*.

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DEGLER IS PAKISTAN EDUCATIONAL ADVISOR

H. E. Degler left with his family for Karachi in mid-August to assume his duties as Advisor on Technical Education to the Central Minister of Education of the Government of Pakistan. He will also act as a liaison field director for the Oklahoma A. & M. College to furnish technical assistance in the planning, development, and putting into operation of three technical institutes. Funds for this program are being provided by the Ford Foundation.

The primary purpose of Mr. Degler's assignment is to assist the Government of Pakistan in the development of a well-rounded system of technical education, and to develop and put into operation the three technical institutes to serve as an example of institutions designed to train technicians and tradesmen to assist in the further development of industry in Pakistan.

COLLINS & GOULD DISSOLVE PARTNERSHIP

Wm. J. Collins, Jr., and G. T. Gould, Oklahoma City and Tulsa, Okla., announced the dissolution of the firm of Collins & Gould, consulting engineers, effective June 1, 1955.

Separate organizations have been established. Mr. Collins will continue his operations in Oklahoma City as Wm. J. Collins, Jr., consulting engineer, with offices at 304-7 Oklahoma Natural Building, Oklahoma City 6, Okla. Mr. Gould will continue his operations at Tulsa as the Gould Engineering Co., consulting engineers, with offices at 226 East 4th St.

Humidity Effects on the Odor Problem

By Richard L. Kuehner*, York, Pa.

SUMMARY — Evidence presented shows that normal concentrations of water vapor affect the rate of volatilization of odors from odorous substances, the intensity of odor in enclosed spaces and the sensitivity of the sense of smell. High humidity reduces the acuity of the sense of smell and hastens the volatilization of odors from certain household substances. Researchers should record wet- and dry-bulb temperatures of inside and outside air, as water vapor affects the rate of odor loss from an inside space. Where the odor source is independent of water vapor effect, as in smoking and cooking, a high relative humidity is advantageous. But where the odor is intrinsic, as with linoleum, paint and upholstery, a reduced indoor relative humidity is beneficial.

THAT HUMIDITY affects the sense of smell or the production and maintenance of odor levels has long been a conversation piece in the air-conditioning industry. The hound dog that works effectively only on humid nights and smells bad only when wet, or the air-conditioning installation which develops offensive linoleum odors under high moisture, but not under dry conditions, suggests that an approach, if not the solution itself, to the odor problem might be found in proper humidity control. The ASHAE Laboratory is now making a fundamental approach to this problem. What limited previous work has been done is of a nature not designed for useful engineering generalizations.[1,2,3,4,5]

The research discussed here was undertaken to explain certain inconsistencies in odor measurement found during the practical evaluation of potential deodorants. It was designed to gain sufficient knowledge of the control of experimental conditions to yield reproducible answers in formal odor studies. However, the results indicate certain facts of general and immediate use.

Existence of an odor problem depends primarily upon three basic factors: (*a*) the rate of odor production; (*b*) the natural escape of odors from enclosed spaces (as opposed to purposeful removal of odor by deodorization or ventilation), and (*c*) the olfactory sensitivity of subjects perceiving the odor. Relative humidity exerts a major effect on each.

Experimental Procedure

Escape of Odor: Test work was undertaken at York, Pa. in a 1700 cu ft room of standard construction. There was one outside, 2-course brick wall of normal studding, wood lath and plaster, and two windows; three inside walls with plaster and wood lath on both sides of the partitions, and three doors. Inside temperature was automatically maintained at 80 F by a combination of steam coils and electric heaters. Relative humidity was maintained at 25 percent and 50 percent by boiling distilled water in the space and condensing the excess moisture with standard humidistatically controlled refrigeration equipment. No ventilating air was used. Each combination of inside wet- and dry-bulb temperature was termed a test. Outside temperatures and humidities were uncontrolled. Tests were made only on days when desired outside wet and dry bulbs existed and only when there was insufficient air motion to alter normal air infiltration appreciably. After setting conditions, cigarettes were mechanically burned at the rate of 2 per hr (2 g per hr) starting at zero time. This rate simulates normal four-man smoker occupancy. Odor measurements were taken at intervals of 4 and 7 hr from zero time.

Olfactory Sensitivity: Variations in the sensitivity of the nose were determined at the same time and using the same test room just described (chemical measurement of odor was taken periodically to establish that odor had actually left the space under certain test conditions). At each selected odor level, two measurements were taken; one, using dilution air in its normal, dry purified state; the other, using dilution air humidified to 25, 40 or 50 percent RH (relative humidity). Dilution air was conditioned by passing purified air through heated distilled water, condensing to the proper dew point and reheating to 80 F in water baths. Dilution air and room air were always maintained at 80 F; room air always at 50 percent RH. A test consisted of the measurement of a given odor level in the test room by dilution air at zero percent RH and also at one of the other percent relative humidities.

To get a rough extension of the plot of this data, additional odor measurements were made by operators who, inhaling through the nose, had breathed air at zero relative humidity and air saturated with steam in excess of 100 percent RH, immediately prior to sampling. The latter was accomplished by breathing over beakers of boiling triple-distilled water, making certain that the air breathed was not appreciably above 80 F.

Odor Production: The objective was to establish whether or not standard odorous household materials impart different odor concentrations to the air under different relative humidity conditions. Tests were run on 1000 g of onions, 2000 g of carpeting and 1200 g of linoleum, each contained separately in a non-coated steel drum of 2.65 cu ft. After placing the test material in the drum, air, conditioned to the desired experimental temperature and humidity, was flowed through at a rate of 0.58 cfm for 4 hr. This permitted the contained test material to adjust to the experimental conditions. Ventilation was then stopped, and the drum and contents isolated by valves. For each series of tests, odor measurements

*Research Engineer, York Corp.

[1]Exponent numerals refer to References

For presentation at the 62nd Annual Meeting of the AMERICAN SOCIETY OF HEATING AND AIR-CONDITIONING ENGINEERS, Cincinnati, Ohio, January 1956.

were taken at 3 hr and 20 hr from this point. Ventilation air and drum were always maintained at 80 F; zero percent and 50 percent RH ventilation air was used.

Odor Measurement: Odor measurements were taken by the dilution-to-threshold method, using techniques previously described[6]. This consists, briefly, of drawing odorous air by blower from the test room or chamber, diluting this odorous air with measured volumes of purified dilution air until the odor is just detectable by the operator. Dilution air was purified by the activated carbon, dry ice technique[2]. This dries the air to less than 4 grains of moisture per lb of dry air and for convenience is referred to here as zero RH. It has been previously noted that the dilution system is open to question[6,7] in that an odor measurement is valid only if the level of sensitivity of the operator is known and that this sensitivity does not vary from test to test. In this investigation, to insure against such experimental errors, measurements were always taken by two or more operators whose level of sensitivity was established by one or more of the following techniques. Two operators of known and similar sensitivity checked each other for a given odor level, or each was demonstrated to have a uniform sensitivity to xylene or tobacco odor before each test. These checks were previously described[6].

All odor measurements, excepting those demonstrating the effect of humidity on the sense of smell, were made with purified dry dilution air. The sensitivity of the operators used was: 0.001 g of tobacco burned per cu ft of air measured one threshold of odor; air saturated with xylene at 32 F measured 380 thresholds.

Experimental Results

Escape of Odor: As published earlier[6] it was found that with a standard smoking rate of 2 cigarettes per hr, the odor level in a test space would reach 14 thresholds at the end of 9 hr. This work was done in the summer. Subsequent tests run in winter indicated that the odor level would not greatly exceed 1 threshold with 2-4 times this smoking rate. Infiltration and exfiltration as commonly thought of were readily eliminated as causes. Accordingly, examination of humidity difference between inside and outside conditions was made as a formal study. Table 1 summarizes the data. From this the water vapor pressure of each location was calculated. The table compares the odor level differences at various inside-outside water vapor differences. Since the smoking rate in all tests was identical, the effect of this humidity differential becomes apparent. The highest thresholds were found when water vapor pressure outside was equal to or exceeded that of the inside. With each increase of inside vapor pressure over outside there was a concomitant loss of odor. Tests Nos. 1 and 10, which approximate winter and summer operating conditions respectively, illustrate the divergent odor behavior in these two seasons.

Olfactory Sensitivity: In a pure approach the sensitivity of the nose at zero RH should be compared with that at 100 percent RH. Since this was a practical test with the odor room (*i.e.* odor sample) always held at 50 percent RH, the achieving of zero RH air to the nose was impossible no matter how much dried purified air was used to dilute the odorous air. Further, the mixture of dilution-odorous air required to measure 10 thresholds is always drier than the mixture used in measuring two thresholds. It becomes apparent that the so-called dry air measurement is actually a flexible baseline depending upon the odor level to be measured. A series of laboratory tests established that variations in water vapor between 4 and 30 grains per lb of dry air had little effect on olfactory sensitivity. This meant, that for purposes of this investigation, odor levels of less than three thresholds could not be used. Less than two parts of dry air per part of odorous air at 50 percent RH is insufficient to reduce the grains per lb to less than 30.

Table 2 contains selected data showing the general experimental conditions and the range of variation. It demonstrates the method of arriving at percentage reduction of olfactory sensitivity. Odorous air is the odor sample drawn from the standard condition test room. Dilution air A column records the odor level measured with dry dilution air, and dilution air B column records

Table 1 — Variation in Odor Level with Water Vapor Pressure Difference

Test No.	Inside Conditions			Outside Conditions			Odor Level		$V.P._1$-$V.P._2$
	Temp. F deg	RH %	$V.P._1$ mm Hg	Temp. F deg	RH %	$V.P._2$ mm Hg	At 4 hr	At 7 hr	
1	80	49	12.80	29	41	1.70	+1	+1	11.10
2	80	50	13.05	40	42	2.64	+1	+1	10.41
3	80	50	13.05	36	53	2.85	+1	+1	10.20
4	80	50	13.05	40	46	2.89	+1	+1	10.16
5	80	50	13.05	58	47	5.78	2.4	3.3	7.27
6	80	50	13.05	62	44	6.23	4.3	6.1	6.82
7	80	23	6.01	34	41	2.05	6.2	6.7	3.96
8	80	27	7.05	38	78	4.56	5.8	7.3	2.49
9	80	30	7.84	55	68	7.54	6.7	13.6	0.30
10	79	50	12.75	75	60	13.27	8.4	14.0	−0.52
11	80	50	13.05	85	52	15.99	8.8	15.9	−2.94

Table 2 — Effect of Humidity on Odor Measurement

Odorous Air		With Dilution Air A				With Dilution Air B				% Decrease in Sensitivity
Temp. F deg	Grains Water	Temp. F deg	Grains Water	Grains in Mixture	Threshold	Temp. F deg	Grains Water	Grains in Mixture	Threshold	
80	78	80	3	20	4.3	80	78	78	2.3	42
81	77	80	3	15	6.1	80	78	78	3.4	44
79	75	79	4	19	4.7	79	58	63	3.8	19
82	81	81	3	13	8.1	82	65	67	6.8	16
79	74	81	3	11	8.4	82	40	45	7.4	12
80	78	80	2	11	8.8	80	37	41	9.3	+6

measurement of the same odor level with humidified dilution air. The final column is the percent depression of the sense of smell by increased water vapor content. The data are also grouped vertically to show this depression when the dilution air was humidified to 50, 40 and 25 percent. In all cases the grains of moisture to the nose in the dry dilution air measurement was well below the critical point of 30, so all of the comparisons can be considered valid.

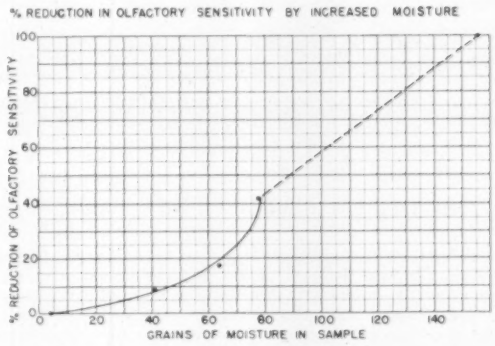

Fig. 1—Percent reduction in olfactory sensitivity by increased moisture

Fig. 1 is a plot of the total data, each point comprising an average of as many as 20 determinations. It illustrates the increasing diminution in the acuity of the sense of smell with increasing water vapor. The dotted extension shows only that sensitivity to normal odor levels does go to extinction in extreme conditions. Because the upper point was determined by a different experimental procedure, it does not strictly compare with the other points on the curve, hence the dotted line.

Odor Production: The final series of tests involved holding various odorous materials in closed vessels at low and at high relative humidities. Linoleum gave the most outstanding results. Table 3 records the odor level reached with similar quantities of linoleum held at zero and 50 percent RH for 3 hr and 20 hr. Each odor level is an average of several determinations. The results are apparent.

This conclusion could not be so factually substantiated by tests on carpeting and onions. With carpeting, no odor appeared under dry air storage. At 50 percent RH, one threshold of odor developed in 24 hr storage. With onions, inconsistent results were found though odor levels were generally higher at high humidity than at low. It was later found that the onions themselves were imparting sufficient humidity to the sample chamber to upset the experimental conditions. An interesting side light of the onion tests should be mentioned. Following each test the sample chambers were ventilated with dry purified air for 24 hr to remove adsorbed odor. It was found that following this treatment so long as the sample chamber was kept dry it remained odorless. When the humidity in the vessel was increased to 50 percent the odor of onions appeared. This could be repeated several times.

Conclusions

High humidity reduces the acuity of the sense of smell and accelerates the volatilization of odors from certain household substances. Increasing the water vapor differential between the air of an enclosed space and that of a surrounding outside space increases the rate of odor loss from the inside space. This imposes previously unrecognized requirements upon the odor researcher. It also gives immediately useful information to the application engineer in understanding certain odor phenomena and suggests potential solutions to specific odor problems or methods of improvement for general odor problems.

Table 3 — The Effect of Humidity on the Volatilization of Linoleum Odors

Time Hours	Odor Level at 0% RH	Odor Level at 50% RH
3	10.6	25
20	17.9	27

It becomes essential that the researcher record wet- and dry-bulb temperature of both inside and outside air to make his work of value to others. For example, Yaglou's recent work[5] showed ventilation requirements for controlling tobacco smoking odor roughly 50 percent greater than previous findings[6]. If the vapor pressure differential of inside over outside were greater in the earlier report than in the latter, a satisfactory explanation is found.

Additionally, use of properly dried dilution air is required for dilution-threshold measurement of odors. Most commercial and experimental dilution apparatus provide methods for deodorizing the dilution air but make no allowance for drying it. This means that in using atmospheric air for dilution, the same concentration of an odor is measured lower on a high humidity day than on a low one. The data here presented indicate that fairly consistent odor levels are measured only when the moisture content of the air to the nose is less than 30 grains per lb of dry air. Above this level slight changes in humidity appear to give major changes in olfactory acuity.

For experimental work on the odor generating properties of materials, a careful control of humidity is necessary, since the rate of odor volatilization varies with humidity. This phenomenon has useful functions. Where background odor arising from the intrinsic odorous qualities of the construction materials of a test space becomes a problem, a reduction in the ambient relative humidity reduces the rate of odor production. Conversely, where odor absorbed on surfaces complicates an experimental program, ventilating the space with high humidity air will help cleanse the surfaces.

For practical odor problems three humidity effects, one negative and two positive, have been demonstrated. The question is, which direction gives the most benefit? Is the olfactory depressing effect of high humidity more beneficial than the opposing odor generating effect, or the reverse? Where the odor generating source is independent of water vapor effect, such as smoking and cooking, a high relative humidity is a consistent advantage in depressing the sense of smell and increasing the vapor pressure differential effect on the loss of odors. Where the odor source is intrinsic, as is the case with linoleum, paint and upholstering, reduction of relative humidity would be beneficial.

Earlier knowledge specified 80 F summer and 70 F winter conditions, but current thinking is shifting toward a 75 F year-round temperature for human comfort requirements. It is equally conceivable that the standard of 50 percent RH may not be the most desirable comfort condition from the odor standpoint.

This work was undertaken for a specific purpose — to better control odor studies. However, the practical signposts are here, but they are only signposts. Until a curve can be drawn showing percent change of olfactory sensitivity with small changes in humidity, and the precise degree of odor loss or generation on many more practical substances defined, the individual engineer must use his own judgment in the application of this knowledge to each odor problem. The data here presented permit the exercising of a judgment heretofore unrecognized.

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ARNO C. FIELDNER RETIRES FROM BUREAU OF MINES

Only Living ASHAE Honorary Member

Dr. Arno C. Fieldner of Washington, D.C., dean of government research scientists and internationally known authority on coal and related fuels, has retired from the Bureau of Mines, after more than 48 years of outstanding Federal service, Secretary of the Interior Douglas McKay announced on July 8.

Inventor, author, and developer of techniques used worldwide in testing and analyzing coal, coke and gas, Dr. Fieldner holds many awards for scientific achievement in his field. Except for two years spent in directing research for the Army's Chemical Warfare Service during World War I, he has served continuously in the Bureau of Mines since 1910.

Born in Ohio in 1881, Dr. Fieldner received his degree in chemical engineering from Ohio State University in 1906. After a brief period in private industry, he joined the Federal Geological Survey at Pittsburgh, Pa., in 1907. He transferred to the Bureau of Mines upon its creation in 1910, and was the Bureau's oldest member in point of service.

Shortly after entering the Bureau, Dr. Fieldner was placed in charge of fuel chemistry research at Pittsburgh, where he served until the Nation's entry into World War I. He then was named head of a Bureau of Mines gas mask investigation unit, which later became part of the Chemical Warfare Service. In this capacity he directed a large group of scientists and engineers in testing and research on military gas masks and gas absorbents. He was commissioned a major in the Chemical Warfare Service in 1918.

Returning to the Bureau of Mines in 1919, Dr. Fieldner was made supervising chemist, and subsequently was appointed superintendent of the Bureau's Central Experiment Station at Pittsburgh. At this time, the ASHAE Research Laboratory was established at the Bureau of Mines with the late John R. Allen as director, and the cooperation of Dr. Fieldner and his encouragement of the Society's program were important factors in its success.

In 1927 Dr. Fieldner went to the Nation's Capital as supervisor of experiment stations, and in 1936 he became chief of the Bureau's Technologic Branch, directing research and development work on mining, metallurgy, and fuels and explosives. When the Fuels and Explosives Service (now the Divisions of Solid Fuel, and Petroleum and Natural Gas) was created in 1942, Dr. Fieldner was named its chief. In 1950, after eight years of directing the Bureau's fuels research, including the expanded research and development program under the Synthetic Liquid Fuels Act, Dr. Fieldner was appointed chief fuels technologist. He occupied that position until last year, when he was made a staff advisor.

Active in many professional and scientific societies, Dr. Fieldner is author of more than 400 articles, reports, and technical publications on fuel testing and research. He directed pioneering studies on the development and standardization of methods of analyzing and classifying coals, the ventilation of vehicular tunnels, the combustion, carbonization and gasification of coal, synthetic liquid fuels, explosives and explosions, and other related activities. He holds honorary Doctor of Science degrees from Ohio State University, the University of Alabama, and the University of North Dakota.

Dr. Fieldner's several awards for scientific achievement include the Lamme and Joseph Sullivant medals, from Ohio State University; the Percy Nicholls Award, conferred by *AIMME* and *ASME*; and honor awards from the *Washington Society of Engineers* and the Washington Chapter, *AIC*. In 1942 he received the Melchett Medal, conferred by the *Institute of Fuels of Great Britain* for notable achievement in work on scientific preparation and use of fuel, and in 1949 he received the Distinguished Service Medal of the Department of the Interior. Honorary Membership was conferred on him by ASHAE in 1944.

Dr. Fieldner said his plans for retirement include traveling, fishing, and some writing on fuel technology and his experiences in the Bureau of Mines. He resides at the Cosmos Club, Washington.

THE PRESIDENT'S PAGE

Cooperation Is Our Duty

EVEN though our Society is fundamentally concerned with advancing the arts and sciences of heating, ventilating, air conditioning and cooling, the interests of our members properly include an extremely wide variety of activities. The very nature of our membership, made up as it is of consulting engineers, educators, manufacturers, design engineers, service engineers, operating and sales engineers, and others, makes it sometimes seem that there is more diversity than unity of interest within our group. This situation frequently shows itself when subjects are being selected for our technical sessions and chapter meetings. What appeals to one group frequently does not appeal to another.

What provides unity is that essentially we are all engaged in using a common technology. Sometimes we apply it to provide a livable human environment in a building or in cars and buses. At other times, the application may call for an environment for improving productivity. Again we may use our technology to establish an environment to improve product quality or to make various processes possible. On occasion, we make use of it to remove or control air-borne dusts, noise or odors.

In accomplishing these applications, we must work and cooperate with many others who are equally skilled and essential, but who are applying methods of their own. It is becoming constantly more important that we recognize our function of creating the air environment while other engineers provide lighting, sanitation, and other essential facilities. In the same way, architects and builders perform the function of designing and constructing buildings which so frequently form the structure within which we are expected to do our part by creating the desired air environment.

It is believed that much can be gained if we learn to play a more important role in activities such as joint committees with architectural organizations, other societies and associations. Another such activity is the joint conference where programs are frequently helpful to our Society and to which our members can make important contributions.

As a single example of such a joint conference, take the case of the one planned by the Building Research Institute to be held later this year. This Institute represents the first concerted effort by private enterprise to stimulate and coordinate the technical advancement of the building industry, an industry which employs 9 percent of the Nation's workers and uses more raw materials than any other economic activity. The Institute is a part of the National Academy of Sciences which is a private non-profit organization of scientists dedicated to the furtherance of science and its use for the general welfare. It is of interest that the National Academy of Sciences was established in 1863 under a congressional charter signed by President Lincoln. Although the Academy acts as an advisor to the Federal Government in scientific matters, it is a private and not a government agency. A number of our members will participate in this conference and it is hoped that this will help to provide a closer relationship between those who design and build buildings and those who create and operate the facilities for obtaining the desired environment.

Examples of similar opportunities to take part in joint activities can be found almost without limit. It is suggested that we would do well to be prepared to participate in as many of them as possible both as a Society and as individuals, thereby making available our knowledge and experience for the public benefit and for the advancement of our profession.

J. E. Harris

President

AMERICAN SOCIETY OF HEATING AND AIR-CONDITIONING ENGINEERS

Skyline of Cincinnati taken from Northern Kentucky Shores

Vas you efer in Zinzinnati?

Cincinnati, the home of two presidents, Rutherford B. Hayes and William Howard Taft, will be the site of the 62nd Annual Meeting of the Society, January 23, 24, 25, 1956. Meeting headquarters will be the Sheraton-Gibson Hotel, and the meeting will be called to order by Pres. John E. Haines at 9:30 Monday morning, January 23.

A full and interesting program is being planned, and in addition to the transaction of Society business it is expected that there will be five technical sessions and two symposiums. On the lighter side there will be an entertaining Get-Together Party on Monday evening and the Annual Banquet on Wednesday evening. A number of special events for the ladies are included on the program.

Authoritative men in their respective fields will appear on the panels for the two symposiums. One symposium will have as its subject High Velocity Air Distribution, and the other will be a discussion of Air Pollution.

The technical papers tentatively planned for presentation include such subjects as the effects of moisture on the flow of heat, performance of covered hot water floor panels, panel heating, methods of measuring heating and air-conditioning equipment noise, thermal circuits, the effects of humidity on odor, an index for evaluating worker performance in hot industries, and high velocity systems in multi-room buildings.

Committee on Arrangements

The Cincinnati Chapter Committee on Arrangements for the 62nd Annual Meeting has held several meetings under the chairmanship of A. W. Edwards, assisted by Vice Chairman H. E. Russell. The honorary chairman is H. E. Sproull, treasurer of the Society in 1951 and a member of Council from 1948-51. The activities of the committee have been assigned to eight subcommittee chairmen:—*Banquet*, E. A. Sobolewski; *Entertainment*, C. P. Krantz; *Finance*, E. W. McNamee; *Ladies*, R. C. Beineke; *Publicity*, R. G. Anderson; *Reception*, F. W. Wilson; *Sessions*, H. W. Moore; *Transportation*, N. A. Frankel, Jr.

In addition to a fine program of technical and special events there is much to see in Cincinnati. Though this modern city boasted of a 503,998 population in 1950, back in 1788 the first settlement was established by just 26 hardy pioneers.

Cincinnati was founded through the combined efforts of a vengeful flat boat trader trailing an Indian horse thief and John Cleves Symmes, Congressional Representative from New Jersey.

Members and guests attending the 62nd Annual Meeting will find that the scenic, cultural and social attractions of Cincinnati, as well as its vast industrial development, far surpass Symmes' greatest expectations as he looked at his 2,000,000 acre purchase and dreamed of building a great city by the Ohio River.

A. W. Edwards
General Chairman

H. E. Sproull
Honarary Chairman

Honored by Life Membership

Victor J. Cucci, New York, N. Y. — V. J. Cucci, consulting engineer, was born and educated in New York City. Previous to starting as a consulting engineer in the nineteen-twenties, he had worked in the plumbing and heating contractor's business. When he became a member of the Society, he was a partner in the firm, Kimball and Cucci. He later joined W. A. Brown to form the company, Cucci and Brown, Inc. Still later, he worked on his own as a consulting engineer.

V. J. Cucci
New York, N. Y.

While he was in charge of the heating and ventilating department in the offices of George G. Sharp, marine architect, from 1939 to 1944, Mr. Cucci secured copywright on a ship ventilating system and an electric porthole ventilator. From 1944 to the present, he has been in the consulting business again. In all these connections, he has maintained a New York City location.

Mr. Cucci is a licensed professional engineer in the state of New York. He has been a member of the *ASME, New York State Society of Professional Engineers, New York Society of Architects,* and *Society of American Military Engineers.*

Charles John Doughty, New York, N. Y. —At present, C. J. Doughty is connected with The Austin Co. in their New York offices. Since his birth in San Francisco, Calif., in 1888, he has traveled great distances in the course of his plumbing and heating career.

Mr. Doughty attended the California School of Mechanical Arts. After a year in the employ of George H. Tay Co., San Francisco, he joined the John G. Sutton Co. of the same city, working in the heating and plumbing departments, spending two years in each. There followed brief periods of employ by John G. Sutton subsidiaries in Portland, Ore., and Vancouver, B. C., Canada. In 1911, he returned to San Francisco as secretary and manager of the plumbing department of Scott Co., successors to John G. Sutton Co. He remained with them for several years, interrupted by service with the U. S. Navy.

C. J. Doughty
New York, N. Y.

Shanghai, China, was Mr. Doughty's next port of call. He went there in 1921 to manage the plumbing department of Andersen, Meyer & Co. Later, he formed C. J. Doughty & Co., contractors and engineers, for which he acted as president and managing director. He became a member of the Society at that time.

After 21 years in China, 17 of which had been spent with his own company, Mr. Doughty joined The Austin Co., working in Texas and Oklahoma. He then passed a decade in New York with The Austin Co. before moving on again to Sao Paulo, Brazil as a mechanical engineer for Squibb and Co. He returned to New York in June 1954.

M. William Ehrlich, New York, N. Y. — A member of the Society since 1916, M. W. Ehrlich served on the board of governors of New York Chapter in 1924, and is a Charter Member of the North Jersey Chapter. He has contributed papers which have been published in TRANSACTIONS, and has participated in discussions of work by others. He also gave assistance in the preparation or editing of some of the early issues of THE GUIDE.

Born in London, England, on February 12, 1890, he received technical training at the Mechanic's Institute and Columbia University Extension. Following two years as an apprentice, Mr. Ehrlich joined R. P. Bolton Co., New York, in 1908. Starting as an assistant, he progressed in his four years of employ to drafting, designing and some engineering. In the following years, he was employed by, or associated with, such leading members of the Society as D. D. Kimball, W. H. Driscoll, Homer Addams, F. K. Chew and R. N. Trane. For a while he did editorial work, as editor of *Electrical Age* in 1915 and then as associate editor of *Metal Worker, Plumber & Steam Fitter.* Later, he served on the advisory board of the *Cleveland Engineering Institute.*

M. W. Ehrlich
New York, N. Y.

By 1922 Mr. Ehrlich had earned his license as a professional engineer, and for the next 20 years he maintained professional practice, as well as commercial engineering or business, in New York and New Jersey. After World War II, he joined Fraser, Brace & Co., serving eight years in their New York design department as chief of the mechanical engineering division. He is currently employed by Dean Products, Inc.

Mr. Ehrlich is the author of numerous articles which have been published in trade magazines. He is a member of the *National Society of Professional Engineers*, and is a licensed professional engineer in New York and New Jersey.

Julien W. Mathis, Jr., Chicago, Ill.—J. W. Mathis, Jr., who now enjoys the title of president of the New York Blower Co., has been associated with that company since 1909. At the time he joined the Society in 1921, he was acting as a sales engineer for New York Blower Co., Chicago, Ill.

J. W. Mathis
Chicago, Ill.

J. H. Spurgeon
Van Dyke, Mich.

Born in Chicago on October 23, 1889, Mr. Mathis has made his career in that city. Initially, he was engaged in the erection and testing of fan apparatus. Later, he worked on the preparation of estimates and in sales. In his sales capacity, he made recommendations for heating and ventilating installations. He rose to the presidency after many years of experience.

Joseph H. Spurgeon, Van Dyke, Mich. — The owner of his own business, J. H. Spurgeon has engaged in electrical, mechanical or sales engineering for the past 40 years.

Mr. Spurgeon was born in Missouri on November 8, 1888 and received his B.S. in electrical engineering from the University of Missouri in 1914. He then located with the General Electric Co., Schenectady, N. Y., for two years, testing electrical and mechanical machinery. During the next four years he was connected with E. I. duPont de Nemours & Co. at the smokeless power plant in Hopewell, Va. After the closing of this plant at the end of World War I, he was sent by duPont to Detroit, Mich., to survey the various power plants of the General Motors Corp. Following the project's completion, he entered the power department of the Ford Motor Co., River Rouge, Mich., in charge of design of transmission and distribution of utilities. Later, he was assistant plant engineer for all power plants of Maxwell Motor Co. and Chrysler Corp. In 1922, he joined Froelich and Emery Engineering Co., Detroit, taking charge of power plant appraisal of all the electric railway companies operating in the state of Michigan at that time.

He formed his own sales engineering company in 1923, specializing in the handling of power plant equipment and steam specialties, and has continued in this capacity ever since. While carrying on sales engineering work, he became affiliated with the General Piping Corp., for which he was treasurer for two years and then president for two years. Afterwards, he opened a manufacturing plant, specializing in automation and conveyor systems for power plants and industrial production processes.

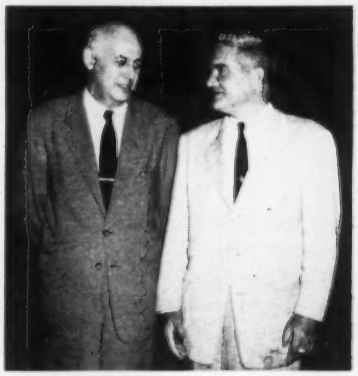
Besides his Society membership, Mr. Spurgeon enjoys membership in *ASME*, the *Association of Iron & Steel Engineers* and the *Engineering Society of Detroit*. His current business location is Van Dyke, Mich.

M. F. RATHER ELECTED TO JOHNSON BOARD

M. F. Rather, vice president, district and export manager, Johnson Service Co., New York, N. Y., has just been elected to the Board of Directors of the company, according to an announcement by J. A. Cutler, president. The Board of Directors also includes Mr. Cutler, R. J. Murphy, vice president and treasurer, and A. J. Otto, vice president and works manager. Mr. Rather, an active member of the New York Chapter, has been a member of ASHAE since 1919, and in 1953 became a member of the select group of Life Members of ASHAE.

AIR CONDITIONING DISCUSSED BY GORDON ON TELEVISION

Helpful suggestions for people contemplating an air conditioning installation were offered by P. B. Gordon, New York, second vice president of the Society, on a Columbia Broadcasting System television program, Sunday, August 14.



P. B. Gordon, ASHAE 2nd Vice Pres. *(left)* and Bill Leonard, who conducts the CBS *Eye On New York* television program

Mr. Gordon expressed his viewpoints on the CBS program, *Eye On New York*, conducted by Bill Leonard. Also appearing on the program to discuss air conditioning were Leonard Engel, feature writer, and W. J. McConnell, M.D., associate medical director, Metropolitan Life Insurance Co., New York, N. Y. Dr. McConnell, who was one of the pioneers in the development of the ASHAE Comfort Chart, answered Mr. Leonard's questions on the health aspects of air conditioning.

During the interview with Bill Leonard, Mr. Gordon commented on the current trends in air conditioning, and indicated that the industry has a healthy and optimistic outlook for the future. He said he believes the trend will eventually be toward more residential central cooling systems.

In choosing a room air conditioner, Mr. Gordon advised his listeners that they should give consideration to any reputable product which will produce the desired results, and that the size of the unit should be determined by surveying the area to be cooled.

Summary of Chapter Meetings*

• *BALTIMORE*: Elections held at the May meeting resulted in the following slate: *President*—E. J. Morris; *Vice President*—W. G. Robertson, Jr.; *Secretary*—E. J. Dull; *Treasurer*—C. E. Rice, Jr.; *Board of Governors*—E. H. Taze, R. E. Dressell and J. K. Wolford.

Pres. E. H. Taze turned the meeting over to Mr. Wolford, who introduced the speaker, C. J. Hemond, Jr., whose talk on *Industrial Sound Control* proved interesting to his audience.

In conclusion, the new president, E. J. Morris, presented a diamond pin to the past president, Mr. Taze, in appreciation for his fine service.

• *EMPIRE STATE CAPITAL*: At the May meeting, Pres. E. C. Doyle gave a complete report of the chapter activities for the fiscal year.

The following officers for the coming year were elected by acclamation: *President*—L. V. Appleby; *First Vice President*—G. G. Davis; *Second Vice President*—H. F. Kruger; *Secretary-Treasurer*—E. J. Mahoney; *Board of Governors*—M. E. Waddell, R. D. Marshall and J. P. Hawn. Attendance 17. Attendance ratio 0.28.

• *GOLDEN GATE*: A discussion of the Semi-Annual Meeting of the Society, held at the June Golden Gate Chapter meeting, was led by S. W. Terry, general chairman, and was directed primarily toward the orientation of the ladies present.

Pres. Eric Roberts announced the following newly elected officers: *President*—D. E. McLeod; *Vice President*—F. K. Crouch; *Secretary*—Herb Duncan; *Treasurer*—J. B. Smith: *Board of Governors*—James McLachlan and R. E. Conner. Mr. Roberts turned the gavel and charter over to D. E. McLeod, the new president. J. E. Murray presented an honorary past president's pin to Mr. Roberts.

The following committee chairmen were appointed by President McLeod: *Meetings*—F. K. Crouch; *Membership*—R. E. Conner; *Reception*—Clyde Wilson-Reid; *Attendance*—J. I. Sprott; *Finance*—J. B. Smith; *Auditing*—H. R. Scandrett; *Legislative*—J. C. Beckett; and *Publicity*—T. E. Brewer. The meeting was concluded with the showing of a film on California.

• *MEMPHIS*: *Modern Thoughts on Air Conditioning* was the title of a talk by V. F. Self, regional manager, Anemostat Corp. of America, New York, N. Y., at the June meeting. Introduced by J. B. Lammons, Mr. Self covered the various types of commercial air-conditioning systems, primarily the high velocity and high pressure system with either single or dual ducts. Mr. Self commented that this system affords space-saving in both existing and new buildings, retains the benefits of the central station system in that machinery and maintenance work are remote from the occupied area, and is flexible in permitting manual or thermostatic control by zones or rooms. As to cost, he considers the system to be competitive on the basis of results achieved.

Vice Pres. W. L. Henson, who presided at the meeting, notified those assembled of the death of C. R. Davis, past president of the St. Louis Chapter, who was well known by many of the group. An expression of sympathy was sent to Mr. Davis' family from the Memphis Chapter. Attendance 20. Attendance ratio 0.25.

• *NEBRASKA*: The annual meeting for the announcement of election results was combined with a social meeting in June. O. J. Smith, chairman of the nominating committee, announced the newly elected slate: *President*—T. E. Davis: *Vice President*—L. J. Paulsen; *Secretary*—C. A. Failor; *Treasurer*—M. F. Stober; *Board of Governors*—C. A. Goth, H. A. Barnard and W. B. Howard. The president's gavel was presented to T. E. Davis by outgoing Pres. C. A. Goth with encouraging comment. Attendance 57.

• *NORTH TEXAS*: Water sources for the Dallas metropolitan area were covered by T. C. Forrest, Jr., who was introduced by H. G. Gregerson at the July meeting. In an interesting and entertaining manner, Mr. Forrest traced the history of Dallas water problems and projected some thoughts on future water problems. He concluded that the most logical source of future water supply is from conservation pools which would result from run-off waters and the damming of such rivers as the Neches, Sabine and Sulphur in East Texas, and the further collecting of waters of the East Fork Trinity River and Denton Creek.

Reports were made by D. C. Pfeiffer, chairman, technical advisory committee; G. A. Linskie, alternate, ASHAE Nominating Committee; G. H. Meffert, member, Chapters Conference Committee; and A. P. Flannes, program committee. Pres. J. A. Ray presided. Attendance 81. Attendance ratio 0.35.

• *OKLAHOMA*: Pres. G. E. Ervin, presiding at the May meeting, appointed a tally committee to check the ballots for chapter officers. The committee reported as follows: *President*—J. R. Patten; *Vice President*—F. R. Denham; *Secretary*—A. C. Shelley; *Treasurer*—W. R. Johnson; *Board of Governors*—W. W. Frankfurt, W. J. Collins, Jr., and G. E. Ervin.

Mr. Collins read the letters received from John E. Haines, ASHAE president, and A. V. Hutchinson, executive secretary, in regard to the Oklahoma Regional Meeting. Both letters were greatly appreciated.

New Welding Procedures was the subject of the guest speaker, Victor H. Lyons, divisional sales manager, Eutectic Welding Alloys Corp., Flushing, N. Y. His informative talk covered all phases of welding. Also presented was a sound film demonstrating many of the procedures. Attendance 56. Attendance ratio 0.44.

• *PHILADELPHIA*: At the annual golf outing held in June, all business was dispensed with except the introduction of newly elected officers: *President*—A. M. Robertson; *First Vice President*—C. J. Lubking; *Second Vice President*—P. H. Yeomans; *Treasurer*—C. J. Forve; *Secretary*—R. J. Sigel; *Board of Governors*—J. J. Hucker. The president's plaque was presented to L. M. Church, outgoing president, by C. F. Dietz. Attendance 237.

• *SACRAMENTO VALLEY:* A proposed amendment to the chapter by-laws was approved at the June meeting.

Pres. J. E. Marshall introduced the new officers and turned the gavel over to R. A. Sarro, incoming president. President Sarro congratulated Mr. Marshall on his year as president and presented a past president's pin to him.

After a short intermission, President Sarro introduced L. A. O'Meara, mechanical engineer, Sacramento, Calif., whose talk was entitled *Consulting Engineer—Friend or Foe?* Mr. O'Meara outlined the functions of the consultant, together with his trials and tribulations. He pointed out that the consulting engineer justifies his existence by saving the client more than the consultant's services cost. A spirited discussion followed. Attendance 45.

• *SHREVEPORT:* After the chuck wagon dinner in July to which the members' wives and children were invited, the meeting was called to order by Pres. J. S. Malahy, Jr. The installation of new officers was presided over by Past Pres. W. E. Fitzgerald, who later presented a diamond-studded past president's pin to Mr. Malahy. The new officers installed were as follows: *President*—R. S. Segall; *Vice President*—H. E. Scott; *Secretary*—A. L. Jones, Jr.; and *Treasurer*—L. E. Kneipp. Mr. Malahy expressed his thanks to those who assisted him in the past year. Attendance 48. Attendance ratio 0.58.

• *SHREVEPORT:* The slate of officers announced by the nominating committee in May was unanimously accepted.

A short talk on *Electronic Controls* was given by Gil Avery, J. W. Cherry Co., who displayed a compensated circuit. He explained that since very little control of relative humidity can be accomplished with this type system, the compensated bridge is controlled by an electronic humidistat to reset the dry-bulb temperature to follow the effective temperature curve, thus accomplishing the best comfort conditions possible during summer. Attendance 32. Attendance ratio 0.62.

*Note: The attendance ratios shown represent the membership attendance divided by the chapter membership. These ratios will be useful as a partial indication of interest shown by local chapter members in various types of subjects programmed by the various chapters and may be useful in deciding on subjects for chapter meetings.

Journal Section

• *SOUTH CAROLINA:* Committee reports were given at the May meeting, at which the following officers were elected: *President*—R. K. Rouse; *Vice President*—J. E. McMurray; *Secretary*—B. A. Leppard; *Treasurer*—H. J. Haar, Jr.; *Board of Governors*—F. A. Bailey, Jr.; R. K. Demarest, Jr. and R. F. Donovan. The outgoing officers were asked to say a few words to the chapter. The new president, R. K. Rouse, in behalf of the chapter membership, presented a matching pen and pencil set to Mr. Donovan, outgoing president.

• *WISCONSIN:* ASHAE Pres. John E. Haines, Minneapolis, Minn., spoke at the May meeting on *The Next Ten Years*. President Haines gave a brief economic history of the country in the past ten years, and stated that the Society has a definite responsibility to help meet the demands of the next ten years. Among the new technological fields which will concern all, he cited atomic and solar energy, electronics (including transistors), and automation.

The results of the balloting were as follows: *President*—I. J. Rossiter; *Vice President*—H. K. Forfar; *Treasurer*—H. W. Alyea; *Secretary*—R. D. Rodwell; *Board of Governors*—L. C. Plaehn, O. A. Trostel and W. G. Schlichting. Pres. L. C. Plaehn called for the annual reports of all officers and committee chairmen, and presented a new gavel to the incoming president on behalf of the chapter. Mr. Rossiter, in turn, presented a past president's pin to Mr. Plaehn. Attendance 77.

HEATING AND VENTILATING EXPOSITION CHANGES ITS NAME

The International Heating & Ventilating Exposition, also known as the Air-Conditioning Exposition, has changed its name to International Heating and Air-Conditioning Exposition, according to a recent announcement by E. K. Stevens, International Exposition Co., New York, N.Y., who manages the exposition.

This exposition, established in 1930, is held on a biennial basis in the odd-numbered years, under the auspices of the AMERICAN SOCIETY OF HEATING AND AIR-CONDITIONING ENGINEERS.

The next exposition, scheduled for February 25 to March 1, 1957, will be held at the International Amphitheatre in Chicago where the exhibit facilities available have been greatly expanded to house exhibits on one floor.

The last exposition, held in Philadelphia in January of this year, was attended by over 21,000 engineers, architects, contractors, and others interested in all phases of the heating, ventilating, and air-conditioning industry.

Candidates for Membership

The Society's By-Laws require that all applications for membership or advancement are to be sent to the Executive Secretary and the names of applicants and their references shall be printed in the next issue of the JOURNAL of the Society, or mailed to all members. When the replies are received from references the Candidate's application shall be submitted to and acted upon by the Admission and Advancement Committee as soon as possible.

When the Admission and Advancement Committee has acted favorably upon a Candidate's application and assigned his grade, the Council shall confirm the election of the proposed Candidate for membership. During the past month there have been 26 applications for membership, including 4 reinstatements; in addition 17 advancements have been received. The names of these men and their sponsors are published in the following list.

Members are requested to scrutinize the list with care. The Admission and Advancement Committee, and in turn, the Council, urge members to assume their share of responsibility of receiving these candidates into membership by advising the Executive Secretary promptly of any whose eligibility for membership is in any way questioned.

All correspondence in regard to such matters is strictly confidential, and is solely for the good of the Society, which it is the duty of every member to promote.

Unless objection is made by some member by September 30, 1955, these candidates will be voted upon by the Council. Those elected to membership will be notified by the Executive Secretary immediately after election.

Note: †Reinstatement. *Non-member. △Advancement.

California

CHANDLER, R. B., Sales Engr., American Blower Corp., Los Angeles. REFERENCES: C. S. Anderson, L. B. Davenport, Joshua Kheel, R. C. Taylor.

KAMBE, T. J., Mech. Engr., Flewelling & Moody, Archts., Los Angeles. REFERENCES: J. S. Earhart, A. J. Hess, G. D. Lord, W. A. Tappendorf, Jr.

SUESS, P. A., Br. Mgr., Fairbanks, Morse & Co., Los Angeles. REFERENCES: C. S. Anderson, A. P. Darlington*, E. C. Evans, C. E. Hollingworth.

Illinois

△BAREITHER, H. D., Asst. Prof. of Mech. Engrg., University of Illinois, Urbana. REFERENCES: J. R. Carroll, Jr., J. R. Fellows, S. Konzo, R. J. Martin*.

△KLIPP, J. M., Partner, R. J. Abramson & J. M. Klipp, Chicago. REFERENCES: R. J. Abramson, John Geiger*, W. J. Klien*, George Lindstrom*.

△LA ROI, G. H., JR., Vice President, McDonnell & Miller, Inc., Chicago. REFERENCES: M. F. Blankin, W. G. Boales, John W. James, E. N. McDonnell.

Indiana

KASHNER, W. H., Partner, Brunsma & Kashner, Cons. Engrs., Lafayette. REFERENCES: J. H. Elliott, A. C. Lane*, T. B. Speaker*, W. W. Timmis.

△PATTERSON, G. V., Sales Mgr., Jenn Air Products Co., Inc., Indianapolis. REFERENCES: O. P. Bullock, H. C. Sharp, E. H. Taze, R. L. Wells.

Louisiana

△ADAMS, F. W., Air Cond. Engr., United Gas Corp., Monroe. REFERENCES: O. H. Atkins, A. Beech*, G. H. Edwards, I. E. Rowe.

MAY, O. M., Owner-Mgr., Dixieaire Ventilating Co., Shreveport. REFERENCES: S. W. Beaty, J. L. Collins, Jr., R. M. Hood, J. I. Menefee.

Maryland

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Massachusetts

MCDONALD, J. E., Bus. Adm., Westinghouse Electric Corp., Boston. REFERENCES: Philip Cohen, S. H. Downs, C. J. Trickler, T. A. Walters.

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Michigan

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MONTEITH, J. E., Mech. Engr., Spitzley-Rettenmier Sheet Metal, Detroit. REFERENCES: J. G. Black, Jr., L. A. Burch, R. H. Oberschulte, J. H. Spitzley.

Minnesota

MCNIESH, R. J., Engr., Assoc., Haarstick Lundgren & Assocs., St. Paul. REFERENCES: J. T. Baker, D. S. Haarstick*, J. J. Strobel*, E. R. Williainan.

Missouri

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Montana

△Niblack, L. D., Br. Mgr., American Blower Corp., Billings. References: A. W. Cooper, J. J. Johnson, J. H. McCabe, R. L. Prussing.

New York

Balsam, P. W., Engr., James H. Martin, Inc., New York. References: Ernst Graber, Stanley Kresh, Samuel Shoor*, A. D. Winston.

Kinkel, E. G., Jr., Repr., Barber-Colman Co., Buffalo. References: C. W. Kaupp, J. M. Quackenbush, C. W. Stone, Q. P. Thompson.

St. John, P. L., Assoc. Engr., International Business Machines Corp., Endicott. References: E. B. Fox., Jr., D. J. Girard, L. E. St. John, Merle Weninger.

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Pruette, R. L., Engr., American Moistening Co., Charlotte. References: R. H. Bush*, L. F. Lawrence, Frank Mahon*, W. T. Watson*.

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Oklahoma

†Colen, A. R., Engr., Hockaday's, Oklahoma City. References: T. J. Boyett, J. H. Carnahan, F. R. Denham, R. G. Keif.

△Jensen, C. O., Commercial Sales Engr., Minneapolis-Honeywell Regulator Co., Oklahoma City. References: J. H. Carnahan, W. J. Collins, R. R. Ellis, L. E. Wickline.

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Maier, A. H., Office Engr., Sun Oil Co., Philadelphia. References: V. A. deBerardinis*, O. M. Elliott*, H. S. Mount*, A. C. Strong*.

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Mingea, R. M., Jr., Sales Engr., American Blower Corp., Knoxville. References: J. M. Gallagher, Jr., W. J. McKinney, W. L. Montgomery, J. E. Smith*.

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△Adams, C. D., Jr., Br. Commercial Sales Mgr., Minneapolis-Honeywell Regulator Co., Houston. References: C. V. Chenault, J. E. Haines, D. M. Mills, F. H. Neil.

Gay, G. H., Sales Engr., Baker Engineering Co., Lubbock. References: C. P. Houston, H. L. Mayes, L. C. McKay, R. A. Mixon.

△Hopkins, W. R., Sales Engr., Catlett Engineers, Inc., Dallas. References: W. A. Collins, Jr., H. G. Gregerson, W. H. Kuhn, D. L. Moody.

△McKee, H. G., Sales Engr., Powers Regulator Co., Houston. References: A. F. Barnes, R. G. Lyford, E. H. McLane, C. C. Quin.

Wisconsin

Dzirbik, E. M., Estimator, Wenninger Co., Milwaukee. References: T. R. Christy, I. J. Haus, R. W. Herman, L. C. Plaehn.

Canada

△Appelton, Harry, Pres., Appelton Air Conditioning, Ltd., Toronto, Ont. References: George Batanorf*, A. M. Dion, Bill Ireland*, Karel Rybka*.

Greer, J. L., Mech. Engr., W. L. Wardrop & Assocs., Winnipeg, Man. References: G. R. Adams*, J. L. Barron*, M. W. Chandler*, R. W. McKnight*.

Krussman, H. W., Sr. Engr., D. P. W. Government of Alberta, Edmonton, Alta. References: R. Clarke*, J. H. Kenney, David Panar, R. G. Proudfoot.

Law, G. D., Vice Pres. & Mgr., E. H. Price (Alta.) Ltd., Edmonton, Alta. References: E. K. Cumming, E. H. Price, A. F. Rayner*, R. A. Williams.

Journal Section

Munro, D. G., Sales Engr., Johnson Temperature Regulating Co. of Canada, Ltd., Vancouver, B. C. References: H. W. Alyea, A. F. Edwards, R. A. Malcolm, E. T. Okins.

Argentina

†Jalles, A. R., Cons. Engr., Buenos Aires. References: J. T. Lang, Gerardo Lasalle*, Luis Lix-Klett, R. S. MacLean*.

England

Smith, R. H., Engr., Jr. Partner, E. A. Pearce & Partners, Con. Engrs., London. References: H. L. Egerton, Walter Harding, R. F. Jarrett, E. A. Pearce.

Netherlands

van Leeuven, J. C., Chief Engr., Air Cond. Div., NV. Bronswerk, Amsterdam. References: M. P. De Wilde, N. A. Gardner*, J. W. Markert, E. R. Michel*.

OBITUARIES

JAMES H. CARBONE
New York, N. Y.

James H. Carbone, assistant mechanical engineer, Department of Public Works, New York, N. Y., died on May 15 at the age of 58.

Mr. Carbone, born in New York City on September 30, 1896, attended Cooper Union and Polytechnic Institute. He started his career in the offices of various heating contractors. For about two decades beginning in 1920, he was connected with L. J. Wing Manufacturing Co., New York City. He served as a heating and ventilating inspector for the City of New York previous to joining the Department of Public Works.

He is survived by his widow who lives at their home in Baldwin, N. Y.

CALVIN R. DAVIS
St. Louis, Mo.

C. R. Davis, past president of the St. Louis Chapter, died on June 19. For many years, he was St. Louis branch manager, Johnson Service Co.

Mr. Davis was born in Columbus Grove, Ohio in 1897. Following his graduation from Purdue University in 1919, he joined the Johnson Service, Co., working for brief periods in Chicago and Detroit, and then for several years in Cleveland, Ohio. In

C. R. Davis

1927, he transferred to the St. Louis branch.

Shortly after joining the Society, Mr. Davis served the St. Louis Chapter as secretary, 1931-1933. He successively became second vice president and first vice president of the Chapter, ascending to the presidency in 1936 and the board of governors in 1937. He was alderman of Clayton, Mo. from 1942 to 1950, and was active in Masonic work.

Surviving are his widow, Gertrude Kahle Davis, and sons, Calvin R., Jr., and John V. Davis.

JAMES H. MILLIKEN
Chicago, Ill.

Several past presidents of the Illinois Chapter acted as pallbearers at the burial services held for James

H. Milliken, who died on July 1, at the age of 66. Mr. Milliken was president of Illinois Chapter in 1936 and a member of the Board of Governors in 1937, having served as treasurer, 1933-1934, and vice president in 1935. He served as vice chairman of the Committee on Arrangements for the 55th Annual

J. H. Milliken

Meeting of the Society, which was held in Chicago.

For many years, Mr. Milliken acted as Chicago representative of the American Air Filter Co., Inc., Louisville, Ky. He specialized in power plant designing and construction. A member of the Society since 1923, he was co-author of a paper on *The Architectural Aspect of Concealed Heaters*, which was presented at the 1929 Annual Meeting.

Mr. Milliken was born at Academia, Pa., on April 7, 1889. He was employed as an engineer by Detroit Edison Co. and as manager by Midstates Engineering Co., previous to becoming Chicago manager for Wm. Reed Engineering Co. He became associated with American Air Filter Co. when it absorbed Reed Air Filter Co.

LEIGH E. NELSON
Fort Wayne, Ind.

The Society has received word of the untimely death of Leigh E. Nelson, 27, who succumbed on May 3, 1955, after an extended illness. He worked with A. M. Strauss, Inc., Architect-Engineers, in Fort Wayne.

Born in Decatur, Ind., on April 3, 1928, Mr. Nelson received his B. S. in mechanical engineering from Purdue University in June 1950. Before entering the service in 1952, he was employed by William T. Brookman Co., consulting engineers, Chicago, doing design and layout of heating, ventilating and air-conditioning systems.

Mr. Nelson had been a student member of the Society while at Purdue, and was advanced to Junior Member in 1952. He is survived by his widow, residing in Fort Wayne.

VERNON C. PAGE
Birmingham, Mich.

Vernon C. Page, 64, of Page & Page, Birmingham, Mich., died on June 29. He had been a Society member since 1936.

Ashland, Kan., was the place of his birth on October 7, 1890. He attended the University of Chicago and Babson Institute. For several years, he acted as a sales manager, first for Motors Products Corp., and then for Parsons Manufacturing Co., both of Detroit. Later, he went into sales engineering with Gar Wood Industries, Inc., also of Detroit.

In 1935, he became director of sales, Automatic Heating & Cooling Systems, Inc., Baltimore, Md. He joined Fitzgibbons Boiler Co., Inc., New York, N. Y. as manager of the Air Conditioning Division in 1939, later transferring to their Oswego, N. Y., office. Returning to Detroit in recent years, he became connected with Page & Page just last year.

WILLIAM J. RAPP
Indianapolis, Ind.

Word has been received from the Indiana Chapter that William J. Rapp, 47, died recently. At the time of his death, he was contract manager, The Philip Carey Manufacturing Co., Indianapolis, Ind.

Born in Evansville, Ind., on July 25, 1907, he studied at Reite High School and Evansville College. For fourteen years beginning in 1932, he worked with George Koch Sons, Evansville. Previous to joining Philip Carey in 1948, he had been part owner in a concern doing general insulation work in his home town.

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ASHAE — OFFICERS OF CHAPTERS AND BRANCHES

(60 Chapters; 1 Special Branch; 8 Student Branches)

Date indicates year organized; an address and no city shown signifies same city as headquarters; numeral in parentheses indicates zone.

● **ARIZONA:** 1953. Hdqrs., Phoenix. Meets, 1st Mon. PRES., W. A. Biddle, 3817 N. 15th Ave. SECY., E. P. Maxwell, 39 W. Adams St.

● **ARKANSAS:** 1952. Hdqrs., Little Rock, Ark. Meets, 3rd Tues. PRES., W. J. Franklin, 608 W. Third St. SECY., J. W. Thompson, 1314 Main St.

● **ATLANTA:** 1937. Hdqrs., Atlanta, Ga. Meets, 2nd Mon. PRES., T. A. Barrow, Jr., 302 Ponce de Leon Ave., N.E. (8). SECY., J. A. Marshall, 1415 Howell Mill Rd., N.W.

● **BALTIMORE:** 1949. Hdqrs., Baltimore, Md. Meets, 3rd Wed. PRES., E. J. Morris, 813 N. Calvert St. (2). SECY., E. J. Dull, 1122 N. Charles St. (1).

● **BLUEGRASS:** 1954. Hdqrs., Louisville, Ky. Meets, 2nd Mon. PRES., J. W. May, 215 Central Ave. SECY., A. E. Hausmann, 227 Lowell Ave., Charlestown, Ind.

● **BRITISH COLUMBIA:** 1952. Hdqrs., Vancouver, B.C., Canada. Meets 2nd Wed. PRES., Cornelius Van Boeyen, 636 Drake St. (3). SECY., A. C. Martin, 425 W. Second Ave.

● **CENTRAL NEW YORK:** 1944. Hdqrs., Syracuse, N. Y. Meets, 4th Wed. PRES., F. D. Putnam, 115 Pulsifer Dr., Auburn. SECY., Merle Weninger, 230 Goodrich Ave. (5).

● **CENTRAL OHIO:** 1944. Hdqrs., Columbus, Ohio. Meets, 3rd Mon. PRES., R. A. Wilson, 2240 N. High St. SECY., T. R. Walker, 182 N. Yale Ave.

● **CINCINNATI:** 1932. Hdqrs., Cincinnati, Ohio. Meets 1st Tues. PRES., A. H. Gerdsen, 224 E. Second St. (2). SECY., T. D. Reiley, 1905 Dunlap St. (14).

● **CONNECTICUT:** 1940. Hdqrs., New Haven, Conn. Meets, 3rd Thurs. PRES., E. J. Hoagland, 257 Whitney St., Hartford. SECY., J. D. Pierce, 775 Capitol Ave., Hartford.

● **DELTA:** 1939. Hdqrs., New Orleans, La. Meets, 3rd Tues. PRES., W. B. Martin, Jr., 635 Commercial Pl. (12). SECY., R. K. Goode, 3813 Pine St. (25).

● **EMPIRE STATE CAPITAL:** 1951. Hdqrs., Albany, N. Y. Meets, 2nd Wed. PRES., L. V. Appleby, N. Pearl & Van Woert Sts. (4). SECY., E. J. Mahoney, 45 Colvin Ave.

● **GOLDEN GATE:** 1937. Hdqrs., San Francisco, Calif. Meets, 1st Thurs. PRES., D. E. McLeod, 2415 Green St. (23). SECY., Herb Duncan, 936 N. Linden Ave., South San Francisco.

● **ILLINOIS:** 1906. Hdqrs., Chicago, Ill. Meets, 2nd Mon. PRES., G. G. Freyder, 72 W. Adams St. (90). SECY., Herbert Kreisman, 117 N. Desplaines St. (6).

● **INDIANA:** 1943. Hdqrs. Indianapolis, Ind. Meets, 4th Tues. PRES., J. W. Jackson, 1531 N. Pennsylvania St. (2). SECY., G. W. Vogel, 31 E. Georgia St. (4).

● **INLAND EMPIRE:** 1950. Hdqrs., Spokane, Wash. Meets, 1st Mon. PRES., F. W. Jenkinson, 228 Hutton Bldg. SECY., J. A. Doyle, W. 3018 Broad.

● **IOWA:** 1940. Hdqrs., Des Moines, Ia. Meets, 2nd Tues. PRES., G. J. Kraai, 907 Sixth Ave. (14). SECY., W. A. Schworm, Physical Plant Dept., Iowa State College, Ames.

● **KANSAS:** 1951. Hdqrs., Wichita, Kan. Meets, Tues. after 1st Mon. PRES., Charles Yoe, P.O. Box 2239. SECY., T. L. Roberts, 2008 S. Parkwood Lane.

● **KANSAS CITY:** 1917. Hdqrs., Kansas City, Mo. Meets, 1st Mon. PRES., A. S. Hurt, Jr., 2119 Washington St. (8). SECY., S. C. McCann, 210 W. Tenth St. (5).

● **MANITOBA:** 1935. Hdqrs., Winnipeg, Man., Canada. Meets, 4th Thurs. PRES., G. C. Davis, 212 Waverly St. (9). SECY., A. H. Millar, 342 Mandeville St., St. James (12).

● **MASSACHUSETTS:** 1912. Hdqrs., Boston, Mass. Meets, 3rd Tues. PRES., G. D. Fife, 79 Milk St. SECY., R. F. Curry, 80 Ripley St., Newton Centre (59).

● **MEMPHIS:** 1944. Hdqrs., Memphis, Tenn. Meets, 3rd Mon. PRES., John Hilton II, 4443 Sequoia. SECY., L. V. Eberle, Jr., 1358 Clementina.

● **MIAMI VALLEY:** 1950. Hdqrs., Dayton, Ohio. Meets, 1st Wed. PRES., D. E. Tullis, 1720 Parkhill Drive (6). SECY., L. P. Brehm, Jr., 111 S. Broomfield Rd.

● **MICHIGAN:** 1916. Hdqrs., Detroit, Mich. Meets, 1st Mon. after 10th of month. PRES., D. S. Falk, 4864 Woodward Ave. (1). SECY., J. H. Spitzley, 1200 W. Fort St. (26).

● **MINNESOTA:** 1918. Hdqrs., Minneapolis, Minn. Meets, 1st Mon. PRES., J. S. Locke, 2753 Fourth Ave., S. (8). SECY., F. G. Vogt, 6530 W. Lake St. (16).

● **MISSISSIPPI:** 1953. Hdqrs., Jackson, Miss. Meets, 4th Mon. PRES., J. E. Davis, Jr., P.O. Box 3216, West Jackson (7). SECY., L. H. Smith, 711 W. Capitol St.

● **MONTREAL:** 1936. Hdqrs., Montreal, Que., Canada. Meets, 3rd Mon. PRES., R. J. Ker, 5000 Namur St. (9). SECY., W. E. Jarvis, P.O. Box 61.

● **NEBRASKA:** 1940. Hdqrs., Omaha, Neb. Meets, 2nd Tues. PRES., T. E. Davis, 4303 Dodge St. SECY., C. A. Failer, 1802 Mason St. (2).

● **NEW MEXICO:** 1954. Hdqrs., Albuquerque, N. M. Meets, 3rd Mon. PRES., H. F. Munn, 419 Granite, N.W. SECY., J. K. James, 4462 Avenida del Sol.

● **NEW YORK:** 1911. Hdqrs., New York, N. Y. Meets, 3rd Mon. PRES., Albert Giannini, 385 Madison Ave. (17). SECY., Carl H. Flink, 62 Worth St. (13).

● **NORTH JERSEY:** 1952. Hdqrs., Newark, N. J. Meets, 2nd Tues. PRES., C. H. Smith, 2300 N. Stiles St., Linden. SECY., M. C. Christesen, 196 Everett Pl., Englewood.

● **NORTH TEXAS:** 1938. Hdqrs., Dallas, Tex. Meets, 3rd Mon. PRES., J. A. Ray, 4411 Belmont Ave. (4). SECY., G. H. Meffert, 3328 Greenbrier Dr. (5).

● **NORTHEASTERN OKLAHOMA:** 1948. Hdqrs., Tulsa, Okla. Meets, 2nd Tues. PRES., J. T. McKinney, P.O. Box 5145 (16). SECY., G. A. McCune, 1908 Utica Square.

● **NORTHERN OHIO:** 1916. Hdqrs., Cleveland, Ohio. Meets, 2nd Mon. PRES., L. C. Burkes, 1792 E. 40th St. SECY., R. A. Urban, Sr., 1740 E. 12th St. (14).

● **NORTHERN PIEDMONT:** 1952. Hdqrs., Greensboro, N. C. Meets, 2nd or 3rd Fri. PRES., S. T. Oliver, 2307 Fairfield Ave. SECY., E. D. Frazier, 320 Ashland Dr.

● **OKLAHOMA:** 1935. Hdqrs., Oklahoma City, Okla. Meets, 2nd Mon. PRES., J. R. Patten, 1726 N.W. Fifth (6). SECY., A. C. Shelley, 2946 Nimitz (12).

● **ONTARIO:** 1922. Hdqrs., Toronto, Ont., Canada. Meets, 1st Mon. PRES., M. C. Bailey, 1139 Bay St. SECY., H. R. Roth, 57 Bloor St., W.

● **OREGON:** 1939. Hdqrs., Portland, Ore. Meets, Thurs. after 1st Tues. PRES., Dick Blankenship, Cascade Bldg. (4). SECY., W. B. Hayes, 707 Portland Trust Bldg. (4).

● **OTTAWA VALLEY:** 1952. Hdqrs. Ottawa, Ont., Canada. Meets, 3rd Tues. PRES., E. J. Schownherr, 32 Clarey Ave. (1). SECY., D. W. Banton, 360 Richmond Rd. (3).

● **PACIFIC NORTHWEST:** 1928. Hdqrs., Seattle, Wash. Meets, 2nd Tues. PRES., P. I. L. Winsor, 20031 Marine View Dr., S.W. (66). SECY., M. W. McKinstry, 4017 McGilvra St. (2).

● **PHILADELPHIA:** 1916. Hdqrs., Philadelphia, Pa. Meets, 2nd Thurs. PRES., A. M. Robertson, 1200 Locust St. (7). SECY., R. J. Sigel, 822 Montgomery Ave., Narberth.

● **PITTSBURGH:** 1919. Hdqrs., Pittsburgh, Pa. Meets, 3rd Mon. PRES., C. L. Benn, 420 Blvd. of Allies (19). SECY., E. H. Riesmeyer, Jr., 231-33 Fort Pitt Blvd. (22).

● **ROCKY MOUNTAIN:** 1944. Hdqrs., Denver, Colo. Meets, 1st Wed. PRES., L. L. DeLong, 2027 S. Washington St. (10). SECY., W. V. Burbank, P.O. Box 840.

● **SACRAMENTO VALLEY:** 1952. Hdqrs., Sacramento, Calif. Meets, 1st Wed. PRES., R. A. Sarro, 5412 Argo Way (21). SECY., M. J. Delavan, 405 Meister Way (19).

● **ST LOUIS:** 1918. Hdqrs., St. Louis, Mo. Meets, 2nd Tues. PRES., E. T. Clucas, 4354 Olive St. SECY., N. J. Hubbuch, Jr., 7020 Cornell, University City (5).

● **SHREVEPORT:** 1948. Hdqrs., Shreveport, La. Meets, 3rd Thurs. PRES., R. S. Segall, 848 River Rd. SECY., A. L. Jones, Jr., 753 Gladstone.

● **SOUTH CAROLINA:** 1954. Hdqrs., Columbia, S. C. PRES., R. K. Rouse, P.O. Box 3731, Greenville. SECY., B. A. Leppard, P.O. Box 3294, Station "A," Greenville.

● **SOUTH TEXAS:** 1938. Hdqrs., Houston, Tex. Meets, 3rd Fri. PRES., J. W. Holland, 245 Esperson Bldg. (2). SECY., J. C. Lewis, Box 8188.

● **SOUTHERN CALIFORNIA:** 1930. Hdqrs., Los Angeles, Calif. Meets, 1st Tues. PRES., J. L. McCullough, 1978 S. Los Angeles St. (11). SECY., W. J. Biggar, 6620 Telegraph Rd. (22).

● **SOUTHERN PIEDMONT:** 1952. Hdqrs., Charlotte, N.C. PRES., L. F. Lawrence, Jr., 212 Greystone Rd. SECY., G. C. Garrett, P.O. Box 3697.

● **SOUTHWEST TEXAS:** 1946. Hdqrs., San Antonio, Tex. Meets, 3rd Tues. PRES., F. B. Frazee, 1013 Riverside Dr., Austin (4). SECY., J. L. Rea, Jr., 300 West 8th St., Austin.

● **TOLEDO:** 1954. Hdqrs., Toledo, Ohio. PRES., C. F. Hoffman, 523 Spitzer Bldg. (4). SECY., R. I. Fruth, 1316 Adams St. (2).

● **UTAH:** 1944. Hdqrs., Salt Lake City, Utah. Meets, 3rd Thurs. PRES., A. A. Maycock, P.O. Box 36 (10). SECY., W. L. Stuewe, 1472 S. State St. (4).

● **VIRGINIA:** 1946. Hdqrs., Norfolk, Va. Meets, 3rd Wed. PRES., T. B. Carpenter, 8400 Millard St. SECY., C. G. Conaway, Jr., 4701 Colley Ave. (5).

● **WASHINGTON, D. C.:** 1935. Hdqrs., Washington, D. C. Meets, 2nd Wed. PRES., W. C. Reamy, Jr., 720 Mills Bldg. (6). SECY., S. H. Robbins, Jr., 2117 M Street, N.W. (7).

● **WEST TEXAS:** 1953. Hdqrs., Lubbock, Tex. Meets, 1st Tues. PRES., R. S. Carow, P.O. Box 3206. SECY., H. L. Mayes, P.O. Box 151.

● **WESTERN MASSACHUSETTS:** 1955. Hdqrs., Springfield. PRES., R. E. Cross, 114 Boston Rd. SECY., F. A. Ferraro, 172 Chestnut St.

● **WESTERN MICHIGAN:** 1931. Hdqrs., Grand Rapids, Mich. Meets, 2nd Mon. PRES., F. W. Brundage, 512 N. Park St., Kalamazoo (11). SECY., F. L. Murray, 482 W. Michigan Ave., Battle Creek.

● **WESTERN NEW YORK:** 1919. Hdqrs., Buffalo, N. Y. Meets, 2nd Mon. PRES., C. W. Kaupp, 271 Delaware Ave. (2). SECY., J. P. Guerra, 96 Cottage St. (1).

● **WISCONSIN:** 1922. Hdqrs., Milwaukee, Wis. Meets, 3rd Mon. PRES., I. J. Rossiter, 231 W. Wisconsin Ave. (3). SECY., R. D. Rodwell, 4781 N. Elkhart Ave. (11).

SPECIAL BRANCH

● **SWITZERLAND:** 1952. Hdqrs., Zurich. PRES., H. C. Bechtler, Anemonenstrasse 40 (47). SECY., Walter Hausler, Erbstrasse 2, Kusnacht.

STUDENT BRANCHES

● **NORTH CAROLINA STATE COLLEGE:** 1948. Hdqrs., Raleigh, N. C. PRES., Alvah Ehrman, Box 4502, State College Station. SECY., R. W. McDonald, 2502 St. Mary's St.

● **OKLAHOMA A. & M. COLLEGE:** 1950. Hdqrs., Stillwater, Okla. PRES., C. E. Durrett, 1215 College. SECY., R. M. Jauch, 308½ W. Maple.

● **OREGON STATE COLLEGE:** 1949. Hdqrs., Corvallis, Ore. Meets, 1st Wed. after 1st Tues. PRES., P. I. Anderson, 202 N. 10th. SECY., D. W. Strahan, 233 Mall St.

● **PURDUE UNIVERSITY:** 1948. Hdqrs., W. Lafayette, Ind. PRES., D. B. Doucette, Purdue Student Branch, ASHAE, School of Mech. Engrg. SECY., J. W. Deabler, Purdue Student Branch, ASHAE, School of Mech. Engrg.

● **TEXAS A. & M. COLLEGE:** 1946. Hdqrs., College Station, Tex. Meets, 2nd and 4th Tues. PRES., D. F. Carroll, Box 6264. SECY., C. W. Farrar, Jr., Rt. 1, Box 339, Bryan.

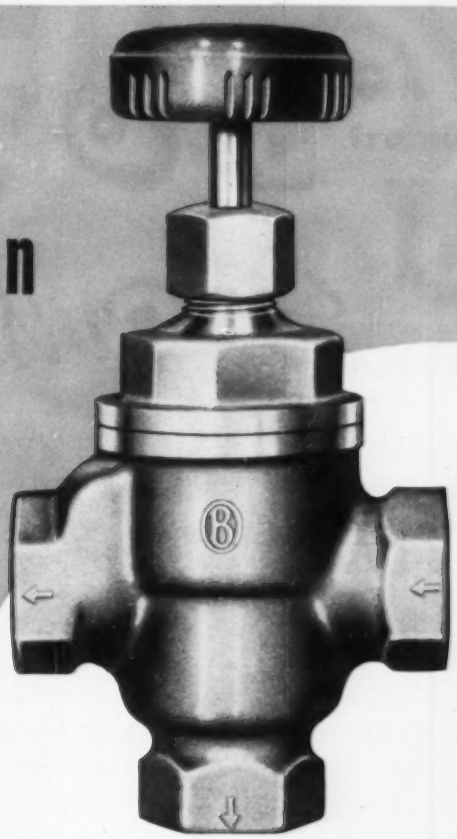
● **UNIVERSITY OF DETROIT:** 1949. Hdqrs., Detroit, Mich. Meets, 1st Tues. PRES., J. C. Rumpf, 16511 Muirland (21). SECY., L. J. Hayes, Jr., University of Detroit.

● **UNIVERSITY OF TEXAS:** 1949. Hdqrs., Austin, Tex. Meets, 1st and 3rd Tues.

● **UNIVERSITY OF TORONTO:** 1951. Hdqrs., Toronto, Ont., Canada. PRES., W. A. Stewart, 86 Roxborough St., W. (5). SECY., R. M. Davies, 144 Manor Rd., E.

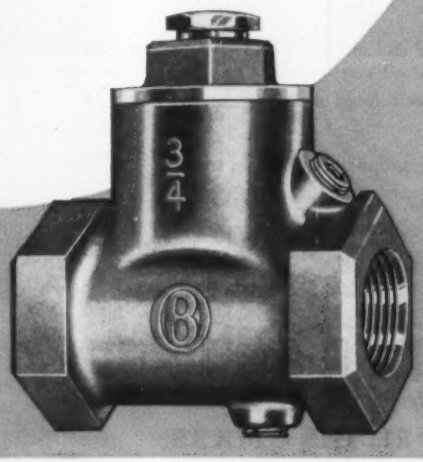
Use this O-B Valve Combination

. . . for complete balancing . . . for individual temperature control in Central Air Conditioning and Heating



Here's the modern way to use valves to regulate operation of a central air conditioning or heating system.

For balancing use O-B Equatemp®, available with either threaded or solder-type pipe ends. It balances *and* shuts off and can be used for purging. Thus it does a job that formerly required two or more valves or fittings.



For separate control of individual units, use the No. 4600, O-B's new low-cost three-way valve. Its parallel, double-seat construction enables occupants of each room to regulate temperature to fit their individual comfort, without affecting other units in the system.

Regardless of the position of the three-way valve, the quantity of water pumped through the system does not change. This means pump delivery remains constant. Danger of overloading pump motors is virtually eliminated.

The 4600 is available with either threaded, or solder-type pipe ends. Use it with the O-B Equatemp to get an easily balanced, closely controlled system at a low price.

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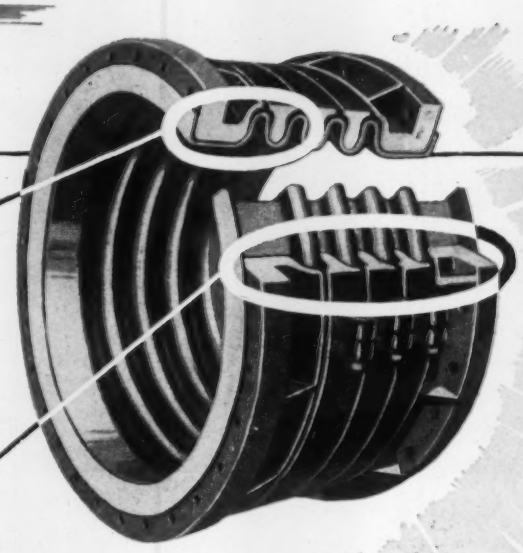
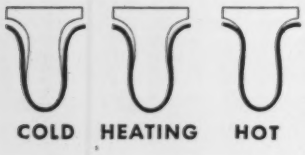


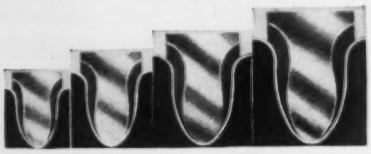
LONG-LIFE FEATURE



the ALL-CURVE, directed flexing, corrugation.*

LONG-LIFE FEATURE

PROPORTIONAL DEPTH of corrugation for each range of diameters and traverse.**



Badger Directed Flexing Self-Equalizing Expansion Joints give exceptionally long service life, proof of which has been well established in the City of New York where more than 4,000 of these Badger Joints are installed in the underground steam lines of the largest district heating company in the world.

*** The exclusive all-curve directed flexing corrugations and matching equalizing rings distribute the flexing stresses over the entire area of all corrugations.**

**** For each range of diameters there is a carefully calculated depth of corrugation with a defined limit of traverse.**

Each Badger Expansion Joint is originally designed with the proper number and depth of corrugations for maximum flexibility and service life at full rated traverse.

Remember — when you want long trouble free service in your distribution system, there is no substitute for the proper number and depth of corrugations. COMPARE BEFORE YOU BUY and to be sure you get the best, specify "BADGER".

BADGER MANUFACTURING COMPANY

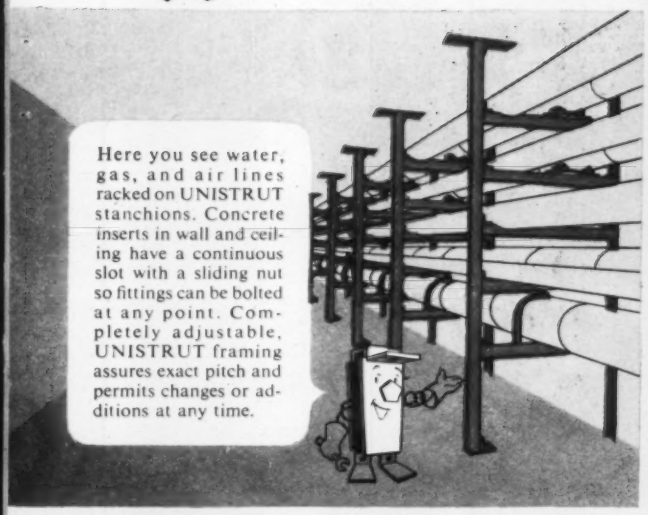
Original and Sole Manufacturer of Badger Expansion Joints

230 BENT STREET • CAMBRIDGE • MASS.

"The Sky's The Limit"

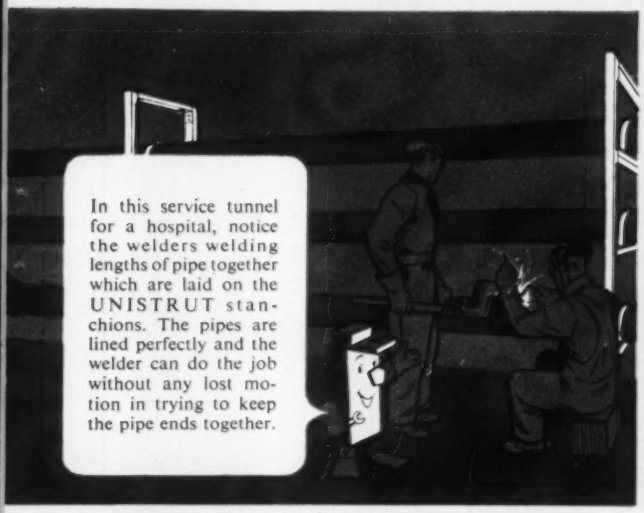
—when you build with UNISTRUT®

Mr. Strut cuts pipe racking costs four ways with UNISTRUT® framing

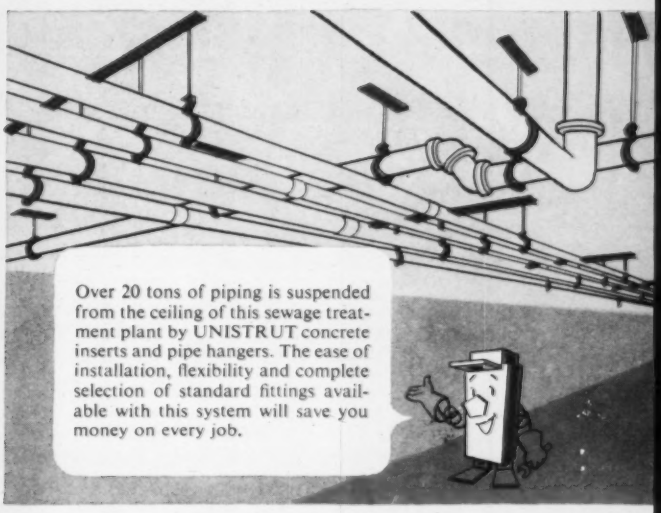


Here you see water, gas, and air lines racked on UNISTRUT stanchions. Concrete inserts in wall and ceiling have a continuous slot with a sliding nut so fittings can be bolted at any point. Completely adjustable, UNISTRUT framing assures exact pitch and permits changes or additions at any time.

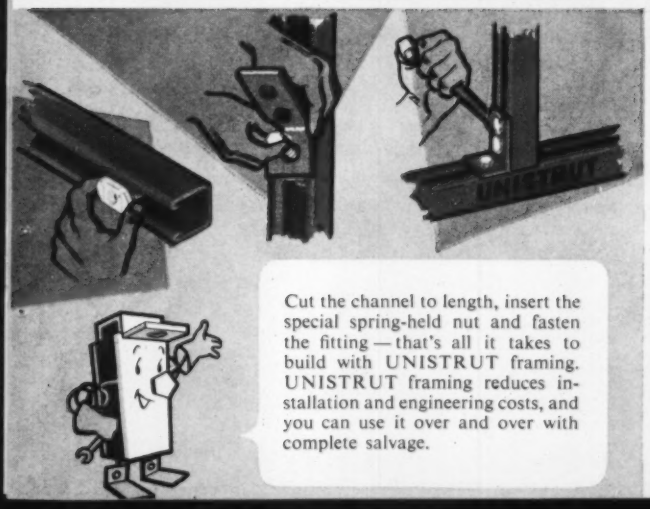
UNISTRUT channels, concrete inserts, pipe rollers, hangers and clamps support all service lines in one neat installation in this tunnel for a public service company. No welding, drilling or special tools were needed! You'll save much time and engineering with this simple, bolt-together framing system.



In this service tunnel for a hospital, notice the welders welding lengths of pipe together which are laid on the UNISTRUT stanchions. The pipes are lined perfectly and the welder can do the job without any lost motion in trying to keep the pipe ends together.



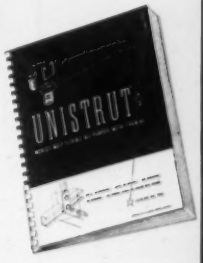
Over 20 tons of piping is suspended from the ceiling of this sewage treatment plant by UNISTRUT concrete inserts and pipe hangers. The ease of installation, flexibility and complete selection of standard fittings available with this system will save you money on every job.



Cut the channel to length, insert the special spring-held nut and fasten the fitting — that's all it takes to build with UNISTRUT framing. UNISTRUT framing reduces installation and engineering costs, and you can use it over and over with complete salvage.

Free Catalog!

Send today for your free copy of the 78-page catalog No. 700. Shows countless examples of how to rack, frame, suspend and support all kinds of mechanical and electrical equipment.



U. S. Patent Numbers

2327587	2541908	2329815	2345630
2363382	2696139	2380379	2405631

Other patents pending

UNISTRUT PRODUCTS COMPANY
1013 W. Washington Blvd.
Chicago 7, Illinois

Dept. H-9

Please send without obligation items checked below:

☐ Catalog No. 700 ☐ UNISTRUT sample

Name.....

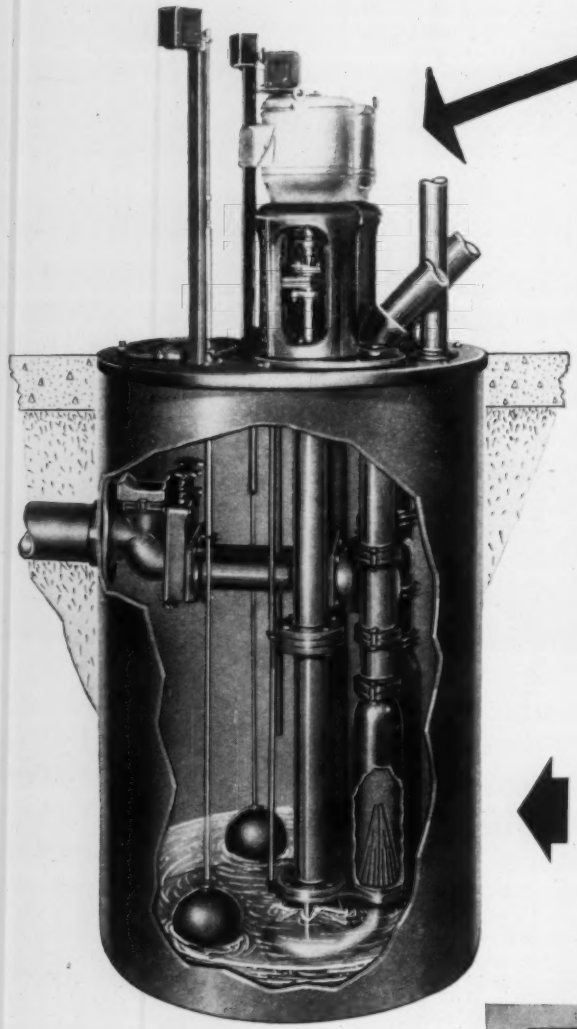
Company.....

Address.....

City.....Zone.....State.....

Avoid pump clogging trouble....

with "FLUSH KLEEN"® SEWAGE EJECTORS



Type "F" submerged
"Flush Kleen" sewage ejector

This is the only truly clog-proof sewage ejector. Only liquid is handled by the impeller. All other air or liquid ejectors have working parts in contact with coarse sewage material that causes clogging. In the "Flush Kleen" all coarse matter is strained out, then back-washed from the strainer into the higher level sewer. Of the more than 8000 "Flush Kleen" sewage ejectors used on ships, military installations, municipal lift stations, commercial and industrial buildings of all kinds, not one has ever clogged.

Protect your client — and your reputation. Guarantee owner satisfaction by specifying "Flush Kleen" sewage ejectors wherever sewage must be pumped.

OPERATING DETAILS

"Flush Kleen" sewage ejectors are usually installed in duplex units and operate alternately. While one pump operates, sewage flows into the wet basin through the idle pump. A strainer ahead of the pump impeller retains all coarse sewage matter. (see cutaway)

When the idle pump starts, the coarse sewage matter in the strainer chamber is flushed into the discharge pipe with liquid sewage.

A special check valve prevents discharges back into the inlet line.

Engineering data showing how to determine sewage ejector capacities for any type or size of building are now available. Write to Dept. A for your copy today.

fmc

CHICAGO PUMP COMPANY

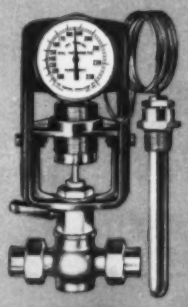
Subsidiary of Food Machinery and Chemical Corporation

BUILDING PUMP DIVISION

622 DIVERSEY PARKWAY • CHICAGO 14, ILLINOIS

Condo-Vac ®, Sure Return ®, AVC, LVC, Fire, House & Circulating Pumps, Pneumatic & Tankless Water Systems . . . Flush Kleen ® Sewage Ejectors, Little Giant ® & Non-Clog Bilge Pumps, Pumps for every Industrial use.

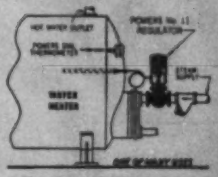
WHY POWERS No. 11 REGULATORS
Give BETTER CONTROL and Last Longer



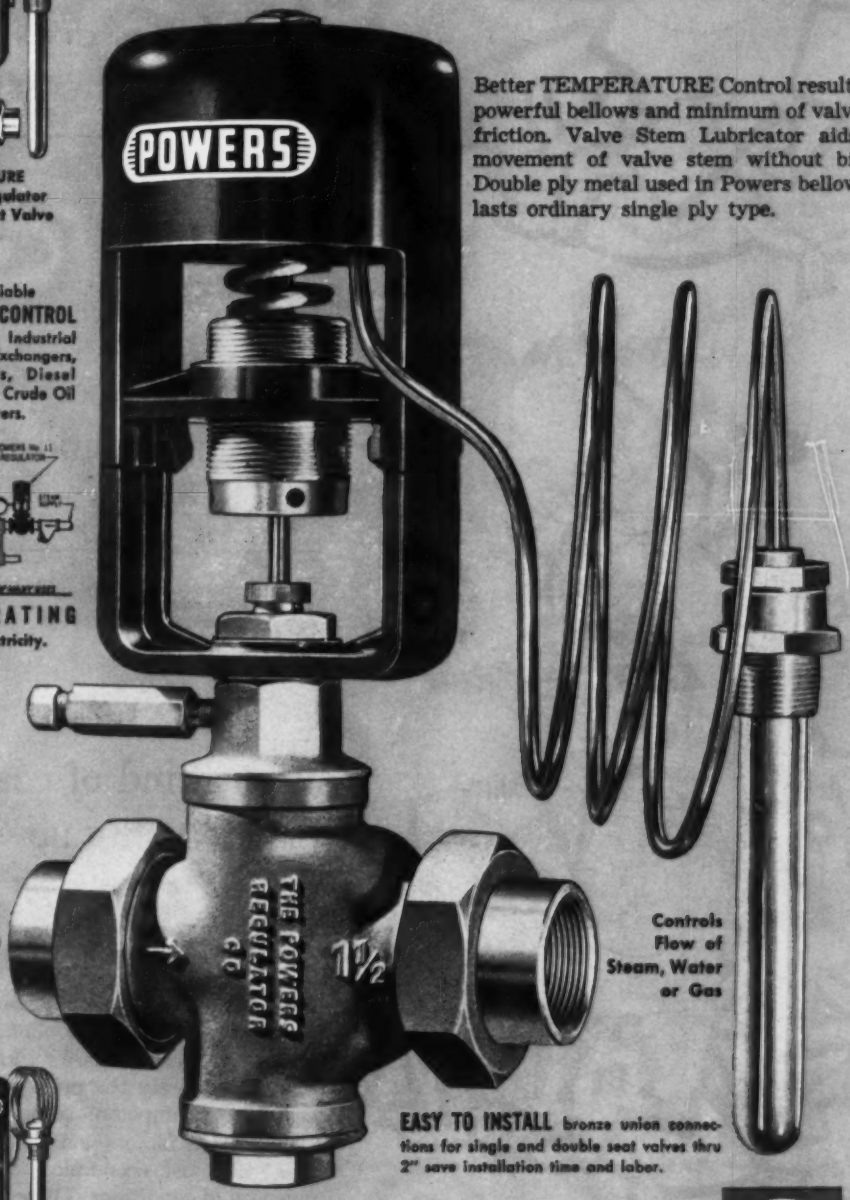
TEMPERATURE Indicating Regulator with Single Seat Valve

Better TEMPERATURE Control results from powerful bellows and minimum of valve stem friction. Valve Stem Lubricator aids easy movement of valve stem without binding. Double ply metal used in Powers bellows outlasts ordinary single ply type.

Simplest, Reliable
TEMPERATURE CONTROL
made for: Many Industrial Processes, Heat Exchangers, Air Compressors, Diesel Engines, Fuel and Crude Oil Heaters and Treaters.



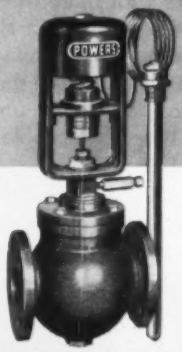
SELF OPERATING
Needs no Electricity.



Balanced (Double Seat) Valve

Controls Flow of Steam, Water or Gas

EASY TO INSTALL bronze union connections for single and double seat valves thru 2" save installation time and labor.



(c44)

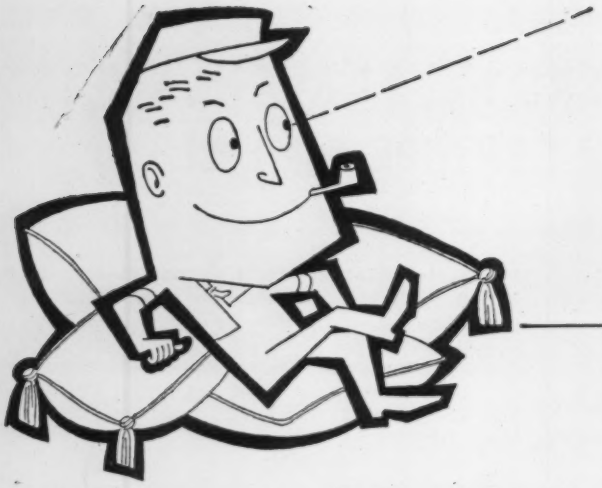
Above: Flanged Iron Body Valve with Double Seat for sizes above 2"

● **15 to 20 Years of reliable service** is often reported by users of Powers Temperature Regulators. Since 1891 they have been noted for their sturdy construction and dependability.

● Right type of Regulator and the right size valve is important for best control. From Powers complete line of self operating regulators and air operated temperature controllers you can be sure of getting the type best suited for your requirements. Call our nearest office or write us direct. 3400 Oakton St., Skokie, Illinois. Offices in Chief Cities.

POWERS CONTROL
Since 1891

THE POWERS REGULATOR COMPANY

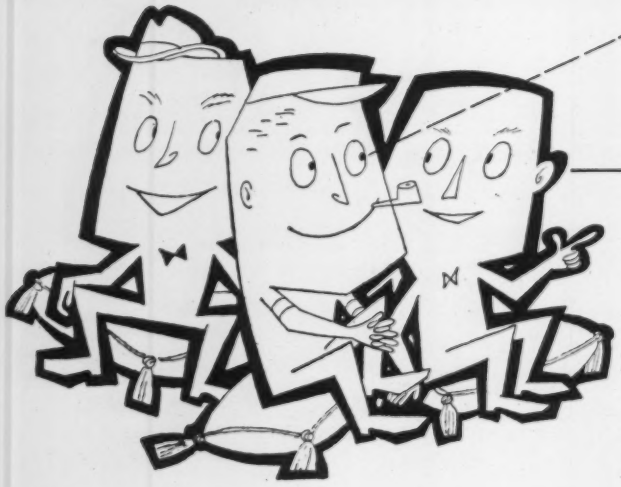


Has that man gotten lazy? All he does is sit and watch the gauges.

The more he sits on his chair, the better I like it. It means the steam pressure is where it should be and everything is fine and dandy.

He used to be jumping around like a monkey on a hot stove.

That was before we got wise and changed our coal.



What kind of coal are we using now?

It's a high quality, low ash coal produced on the Chesapeake and Ohio. The C&O coal man recommended the exact grade best suited to our type of furnace. It burns hot and clean, with practically no smoke or clinkers and very few ashes. I've learned there's a lot more to buying coal than merely the price per million BTU's. It takes a competent combustion engineer to weigh all the factors and pick the coal that will give the most economical operation under a given set of conditions. Those C&O people really know their coals and I'm listening to their advice from now on.

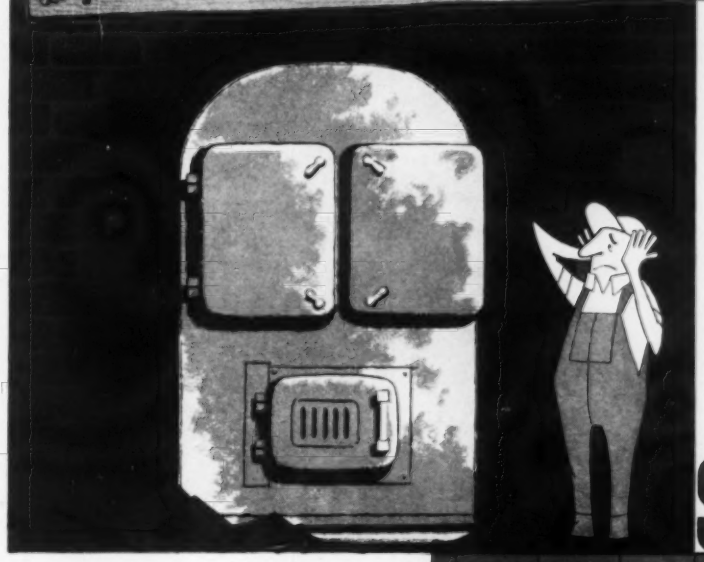
P.S.

There's a lot more to buying coal than the cost per ton. For facts and figures to solve your particular fuel requirements, write to: R. C. Riedinger, General Coal Traffic Manager, Chesapeake & Ohio Railway Company, Terminal Tower, Cleveland 1, Ohio.

Chesapeake and Ohio Railway

WORLD'S LARGEST CARRIER OF BITUMINOUS COAL

Are excessive "entry" costs knocking down your replacement volume?



Just think how many customers in your area would replace their worn-out boilers if it weren't for excessive installation costs. *You can get these jobs* if you . . .

install the unique

SPENCER "LW"

Built in two sections – permits easy entry through narrow basement openings. No tearing out of walls. The two watertight sections can be moved in separately, yet require no welding for installation.

Lower waterline – over-all height of the Spencer "LW" is approximately 25% less than conventional firebox boilers . . . makes possible use in low ceilinged basements . . . and therefore saves excavation expense!

Let Spencer build up your boiler business—write Dept. HP-95

OTHER COMMERCIAL BOILERS IN THE SPENCER LINE

New Spencer "C." Heavy-duty commercial boiler performance at a residential boiler price! Can be fired with oil, gas or coal.

Spencer "A." Complete range of sizes from 3,500 to 50,000 sq. ft. steam, net SBI ratings. For *every* building . . . for *every* fuel.

SPENCER HEATER
LYCOMING DIVISION
WILLIAMSPORT AVCO PENNSYLVANIA

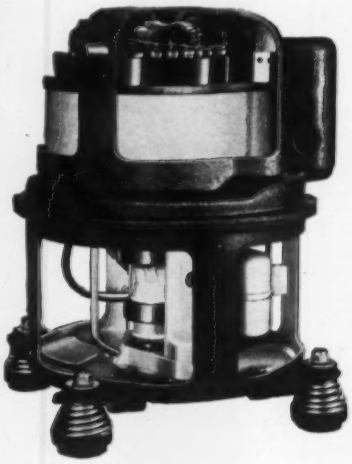
ASME and SBI Approved

COPELAWELD HERMETICS

Engineered for low-cost operation, powered for years of whisper-quiet performance . . . Copeland combines the most-wanted compressor features into COPELAWELD, the ideal unit for your refrigeration and air conditioning products.

Cool-running two-cylinder Copelawelds are free from vibration and chatter. Heavy-duty, high-power-factor motor delivers exceptionally high capacities at minimum current input. Freon-12 and Freon-22 models. Sizes ⅓ H.P. through 1½ H.P.

Get acquainted with the Copeland welded motor-compressor. Field-test Copelaweld in your own equipment, and sample the performance that is the industry's standard. See your Copeland dealer or write us direct.



COPELAWELD
⅓ H.P. through 1½ H.P.

Copeland
DEPENDABLE Electric REFRIGERATION

COPELAND REFRIGERATION CORPORATION
SIDNEY, OHIO

AIR-FACTORS INC

the only manufacturer of a complete line of air distribution equipment

. . . There's a Story Behind Each Product

With these catalogs, Air-Factors, Inc., brings to the air conditioning, heating and ventilating industry a complete line of air distribution and air control equipment. Years of specialized on-the-job experience embracing every phase of air distribution and air control have gone into the individual design of each air supply outlet and return air exhaust inlet. Equal care and consideration have entered into the development of factory and laboratory facilities to give flexible production so that engineering and design will not be limited by inability to produce special sizes and type of equipment necessary to provide proper air distribution for our customers.

A select group of manufacturers' agents represent Air-Factors, Inc. All are qualified to assist in selecting your proper air distribution equipment.

Write for Information

DAMPERS & LOUVERS
Evaporative Cooling Ceiling Outlet
FLEXI-BLADE SERIES
Registers and Grilles
Engineered
Air Volume Dampers, Weather Dampers, Fire Dampers, Door Louvers
Low Cost Registers and Grilles
Opposed Operated Blade Volume Control

AIR-FACTORS INC

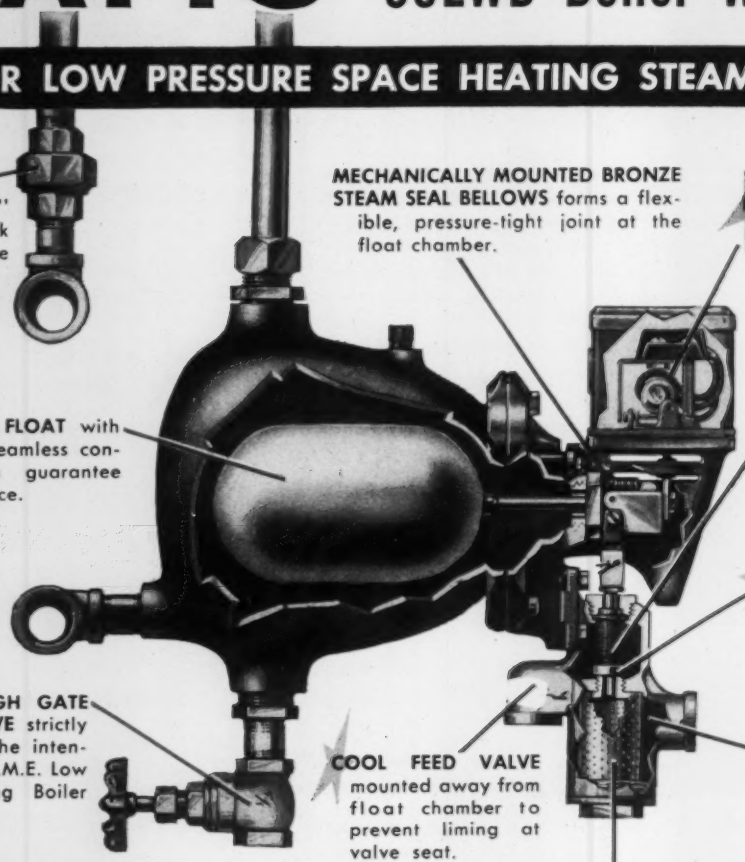
1624 SO. RAYMOND AVE. MONROVIA, CALIF.

SINCE WATTS 1875

WATTS

NEWLY RE-DESIGNED 60LWD Boiler Water Feeder

FOR LOW PRESSURE SPACE HEATING STEAM BOILERS



QUICK HOOK-UP ½" fittings for quick and easy gauge glass connection.

MECHANICALLY MOUNTED BRONZE STEAM SEAL BELLOWS forms a flexible, pressure-tight joint at the float chamber.

NEW MERCURY SWITCH DESIGN has no mechanical parts to stick or fuse.

PURE COPPER FLOAT with reinforced seamless construction to guarantee lifetime service.

FATIGUE-RESISTANT bronze water seal bellows provides a pressure-tight seal and keeps the valve stem guide dry so that it cannot corrode or stick.

WATTS FEED VALVES feature resilient, stickage-proof disc-to-metal seating that will not leak.

STRAIGHT-THROUGH GATE TYPE DRAIN VALVE strictly complies with the intentions of the A.S.M.E. Low Pressure Heating Boiler Code.

COOL FEED VALVE mounted away from float chamber to prevent liming at valve seat.

ENLARGED STRAINER area and sediment space provides an ample free-flow safety factor.

HEAVY GAUGE perforated copper strainer. Easily removed for cleaning.

WATTS 60 SERIES.

Recently added refinements to the proven design of the Watts No. 60 establishes its unquestionable leadership in today's design of boiler water feeders. No better protection can be found.

No. 60 boiler water feeder only (without cut-off switch) for manually-fired steam boilers. An LWD mercury switch assembly may be added in the field at any time to make a combination boiler feeder and low water cut-off for automatic firing.

No. 60LWD. This feeder consolidates the No. 60 with a mercury switch assembly to provide a combination feeder and cut-off with alarm switch.

Series 60 capacity up to 5,000 sq. ft. of radiation. Maximum steam pressure 35 lbs. Maximum water pressure 150 lbs. Has ¼" tapping for pressure switch. Water valve connections ½" S.P.S. Gauge glass connections ½" S.P.S. Height (float chamber only) 8½". Width 5½". Length 12½". Weight 30 lbs.

NOTE: These starred features above make Watts feeders the most advanced boiler water feeders available on the market today.

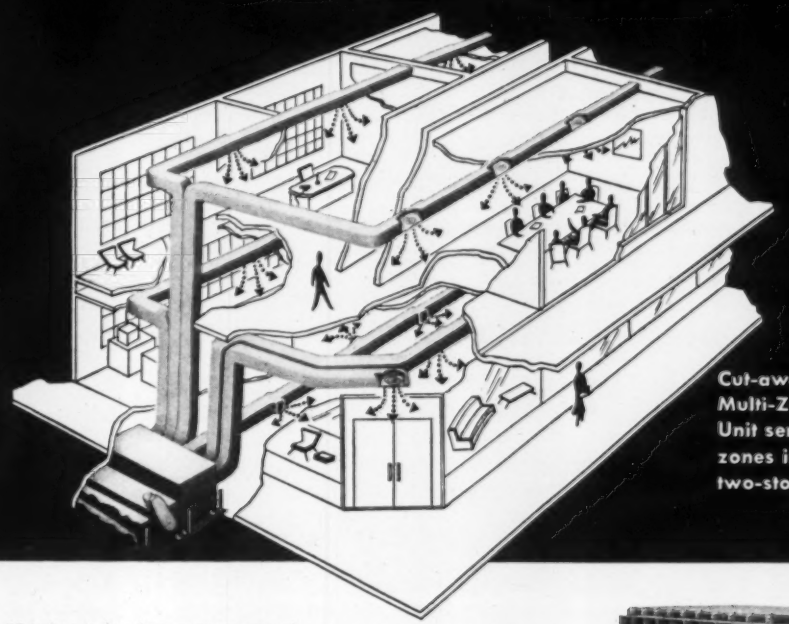
SEND FOR OUR COMPLETE CATALOG LITERATURE

WATTS REGULATOR COMPANY

LAWRENCE, MASSACHUSETTS U.S.A.

Fact:

Westinghouse Multi-Zone Unit *blends* air-mixtures for *simultaneous unequal* cooling loads— Serves *up to 12 separate* zones



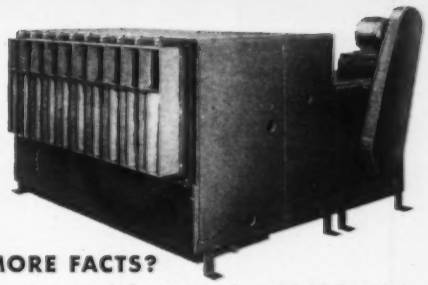
Cut-away view shows Multi-Zone Air Conditioning Unit serving six separate zones in a typical two-story installation.

Here's a rugged, compact central plant air conditioning unit that supplies air, *blended* for simultaneous unequal heat load demands, in various zones requiring individual temperature and humidity control.

Formerly, heat load variations could be controlled only by separate supply systems for each zone, or by expensive zone reheat arrangements.

Now . . . this problem can be solved with a single Westinghouse Multi-Zone Air Conditioning Unit. Efficient . . . economical . . . this versatile unit supplies air . . . conditioned at a central location . . . for the individual needs of as many as 12 zones.

Multi-Zone Units are of the blow-through type with divided outlets to serve multiple zones by supplying heated or cooled air, or controlled mixtures of both, to each zone (12-zone unit illustrated above).



MORE FACTS?

For complete information about Multi-Zone Air Conditioning Units, call on the "Man with the Facts", your Westinghouse-Sturtevant Sales Engineer . . . or fill in the handy coupon below.

WESTINGHOUSE AIR HANDLING

YOU CAN BE SURE...IF IT'S

Westinghouse

I-80448

Westinghouse Electric Corporation
Sturtevant Division, Dept. 5-H
Hyde Park, Boston 36, Mass.

Please send more facts on your Multi-Zone Unit.

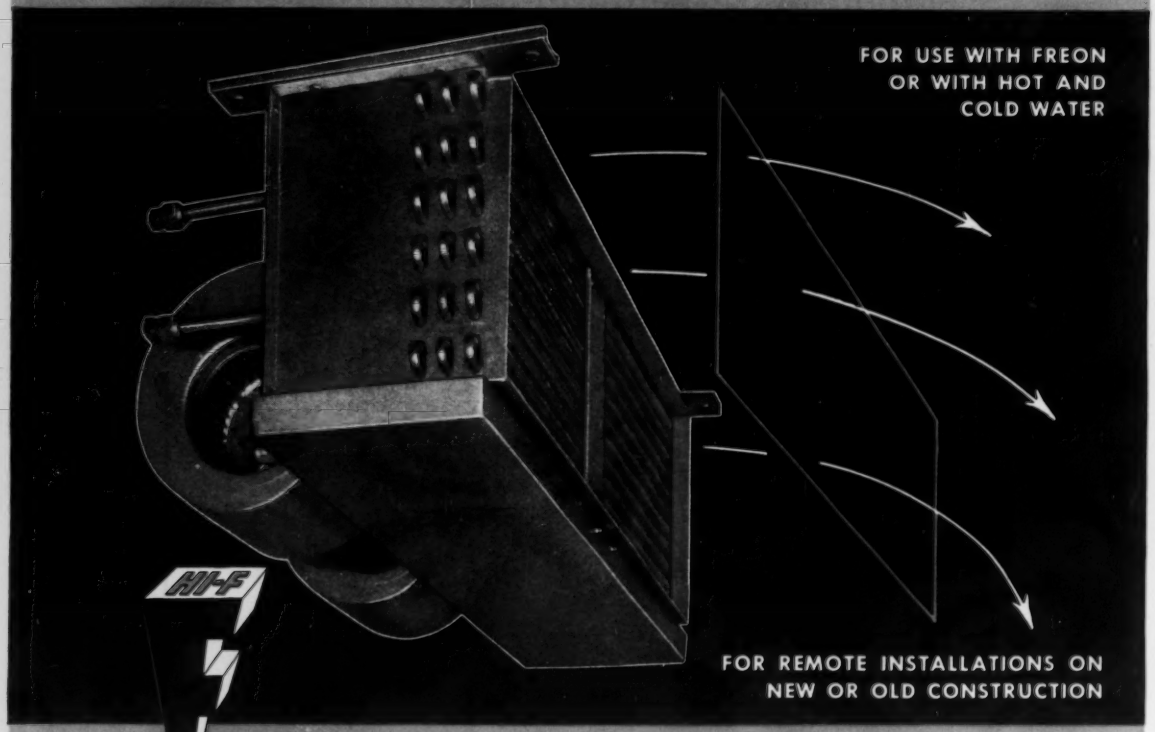
NAME AND TITLE .....

COMPANY .....

CITY ..... STATE .....

CONCEAL-X

THE NEW AIR CONDITIONING UNIT THAT REQUIRES NO FLOOR SPACE



for

MOTELS
HOTELS
HOMES
OFFICES
HOSPITALS
and
General Buildings

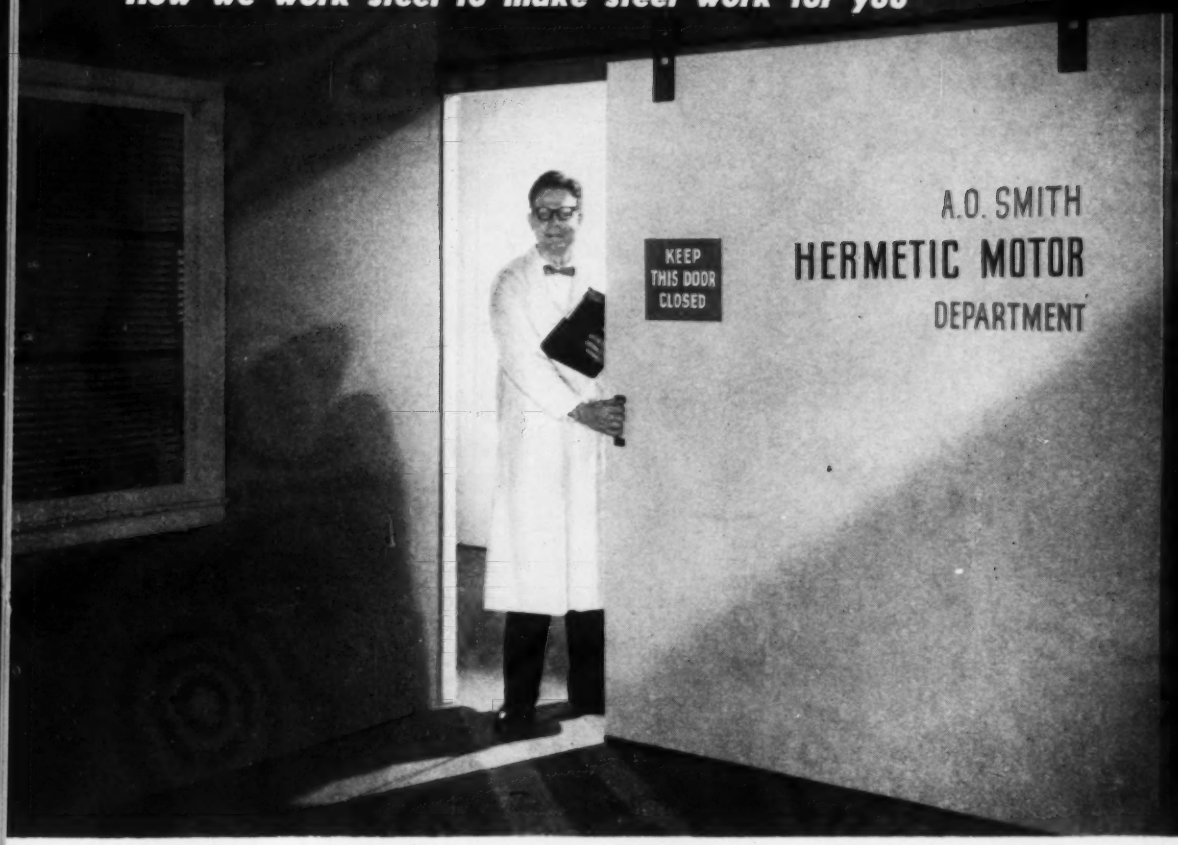
Conceal-X is built to save you money, make you money, and to better satisfy your customer. It is a real space saver designed for use in out of the way places and with the capacity to do a big job *quietly*. Recommended for motels, dwellings and buildings for Winter-Summer air conditioning. Conceal-X, installed in vestibules, overhead entrance ways, plenums, closets or hallways with or without false or furred ceilings, provides horizontal discharge to one or several adjacent rooms. Best of all, Conceal-X incorporates the Peerless patent-applied-for Hi-F finned construction that gives you greater B.T.U. efficiency year after year. May we send you bulletin and specifications?

PEERLESS OF AMERICA, INC.

MANUFACTURERS OF REFRIGERATION AND AIR CONDITIONING COILS SINCE 1912

Dept. H, 5830 N. PULASKI ROAD, CHICAGO 30, ILL., U.S.A.

How we work steel to make steel work for you



Behind these doors, rigid sanitary control helps build hermetic motors that really can be

sealed and forgotten

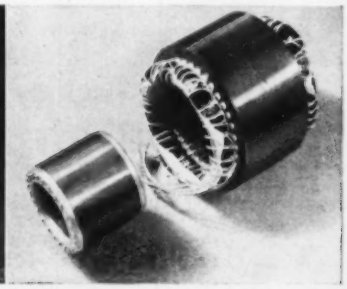
Yes, even the air is filtered in A. O. Smith's Hermetic Motor Department . . . where motors are built to work inside hermetically sealed air conditioning compressors.

And filtered air is far from all! A. O. Smith hermetic motors are made under controlled, sanitary conditions. Temperature and humidity are maintained at precise, predetermined levels. As a result, these motors can really be *sealed and forgotten* — free of performance-wrecking dust and dirt.

This is just one example of A. O. Smith's approach to motor-building. Whatever kind of motor you may need (½ to 150 hp), you'll find our application-engineered units bring out all the performance you expect from the products you build or buy.

Write for free, illustrated literature that tells the complete A. O. Smith motor story . . . also describes the many other ways *we work steel to make steel work for you.*

Special attention to important details, even packaging, assures custom quality and extra dependability in A. O. Smith motors.



Through research A.O. Smith ... *a better way*

A.O.Smith
CORPORATION

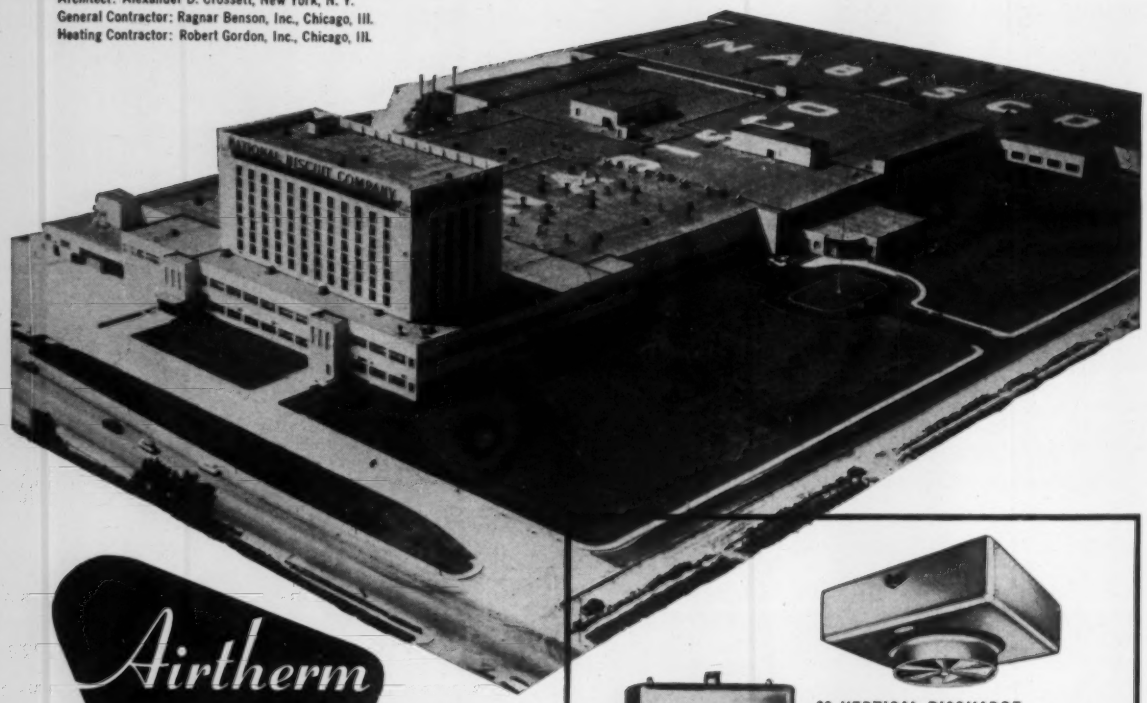
MILWAUKEE 1, WISCONSIN

11 plants in New York, New Jersey, Pennsylvania, Ohio, Wisconsin, Illinois Texas and California

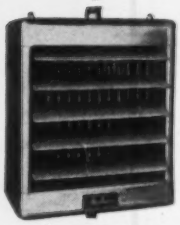
International Division: Milwaukee 1, Wisconsin

National Biscuit Company
Chicago, Illinois

Architect: Alexander D. Crossett, New York, N. Y.
General Contractor: Ragnar Benson, Inc., Chicago, Ill.
Heating Contractor: Robert Gordon, Inc., Chicago, Ill.



Airtherm



90 VERTICAL DISCHARGE HEATERS INSTALLED from 102,500 BTU to 185,000 BTU

92 HORIZONTAL DISCHARGE HEATERS INSTALLED from 14,800 BTU to 250,000 BTU

STEAM UNIT HEATERS

WARM THE WORLD'S LARGEST BAKERY

To achieve flexible, economical heating throughout Nabisco's new $20 million Chicago plant, 182 Airtherm steam unit heaters have been installed. The plant is the world's largest cracker and biscuit bakery with ovens the length of football fields, almost 20 acres of floor space and a capacity of 167 million pounds yearly.

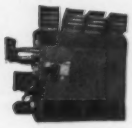
When the area to be heated presents unusual problems, chances are you can solve them easily and economically with the flexibility of Airtherm unit heaters.

Convectors

Vertical Steam Unit Heaters

Horizontal Steam Unit Heaters

Centrifugal Fan Type Unit Heaters



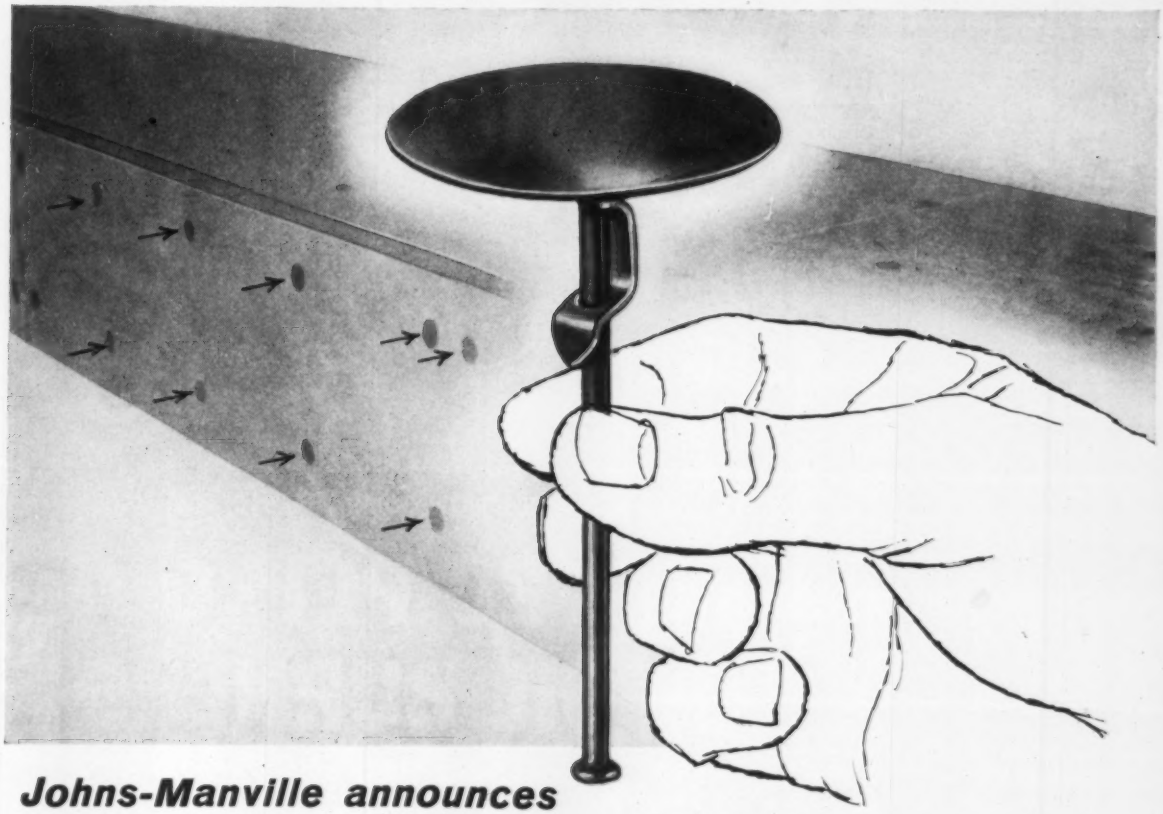
Direct Fired Space Heaters

Gas Fired Unit Heaters

FOR HEATING SATISFACTION . . . THINK FIRST OF

Airtherm

MANUFACTURING COMPANY
700 South Spring Avenue • St. Louis 10, Missouri



Johns-Manville announces

a *Flush Clip* for impaled insulation

Improves appearance **Won't tear vapor barrier**

Safeguards personnel

HERE'S HOW IT WORKS

1. Mechanic depresses insulation exposing tip of pin.

2. Pin is engaged by locking-holes on clip.

3. Clip is pushed home flush with insulation surface.

4. Vapor barrier (where necessary) is easily applied over clip.

Another revolutionary development introduced by Johns-Manville

Now . . . you can insure a smooth and unbroken finish on air conditioning ducts. For this new *Flush Clip*, developed and produced by the Graham Manufacturing Corporation of Royal Oak, Mich., firmly secures impaled insulation without sacrificing eye appeal or impermeability of vapor barrier.

Plant personnel will appreciate the neat, smooth appearance unbroken by ugly protuberances. The Graham® *Flush Clip* also provides an excellent surface for decorative or identification painting. Insulation engineers will be able to furnish a snugger fitting, more efficient job with an unbroken vapor barrier that is easily applied. Installation crews will find their work simplified and speeded—with no trimming and cutting required—and a greatly reduced injury hazard from sharp, jagged projections.

Johns-Manville's Industrial Contract Department has worked closely with the Graham Manufacturing Corporation in field-testing the Graham *Flush Clip* on industrial installations. Used in conjunction with the Graham Insul-Pin System, it has been proven to operate ideally with J-M Spintex Insulation, plain and faced. For more information and samples, contact your nearest J-M Insulation Contractor. Or write Johns-Manville, Box 60, New York 16, New York. In Canada, Port Credit, Ontario.

JM PRODUCTS

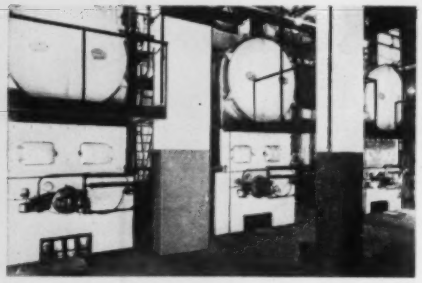
Johns-Manville *first-in* INSULATION

MATERIALS · ENGINEERING · APPLICATION

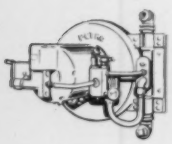
TISHMAN REALTY AND CONSTRUCTION COMPANY, INC. INSTALLED

20 PETRO OIL BURNERS

IN TEN BIG NEW YORK BUILDINGS



Sutton Terrace (shown at top) consists of three 12-story buildings accommodating 495 families. Heat is supplied by three Titusville boilers, each rated at 42,500 sq. ft. of radiation and each fired with a WD 8 AH Petro burner. This installation has three 15,000 gallon, 10 ft. diameter fuel storage tanks.

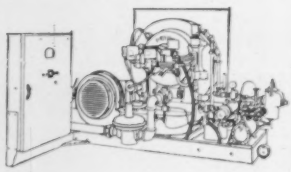


ROTARY OIL BURNERS

Horizontal rotary oil burners make possible substantial fuel savings by burning the low-cost heavy fuel oils with complete dependability. Models for every industrial need. Capacities up to 600 boiler horsepower.

COMPLETE PACKAGED UNIT

A complete forced draft combustion system with all parts factory assembled and tested. Saves installation time and cost, gives top performance and fuel economy.



***"Petro oil burners give us the cleanliness, dependability, and economy of operation we require,"* says Alan Tishman**

Providing heat for 9 huge apartment developments and power for a 13-story manufacturing plant is a tremendous responsibility, but Tishman Realty and Construction Co. Inc., have found that they can rely on Petro oil burners to do the job. "The ability of our Petro oil burners to immediately respond to fluctuating heat and power demands without over-firing or under-firing is a vital factor in keeping our fuel costs low and our tenants happy," says Mr. Alan Tishman.

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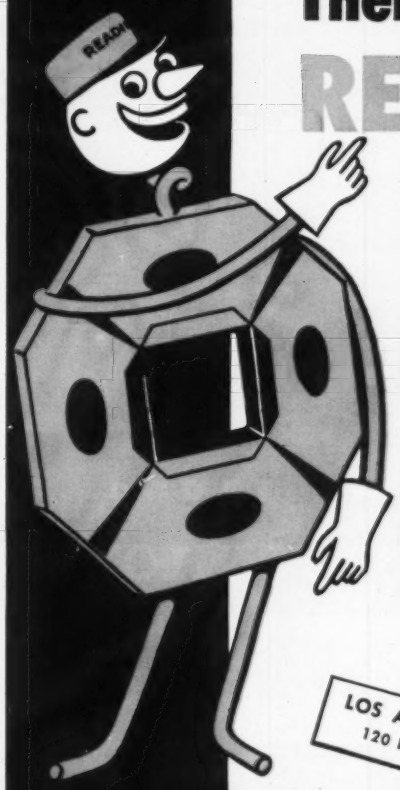

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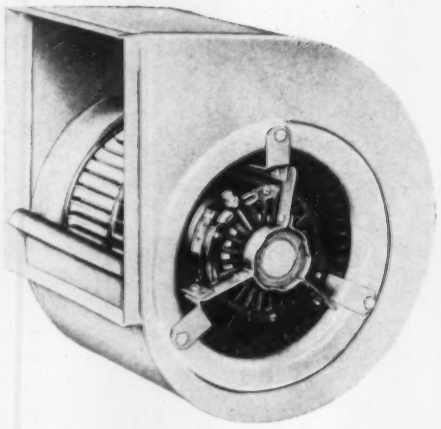

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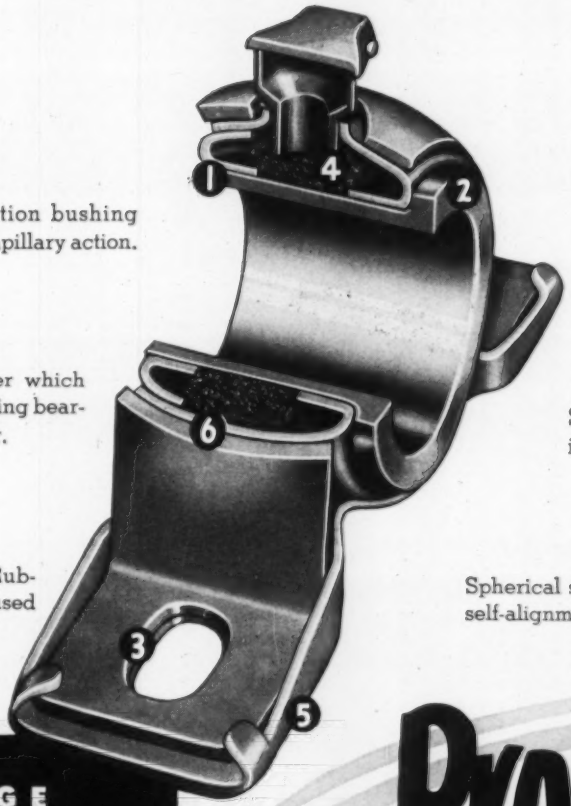

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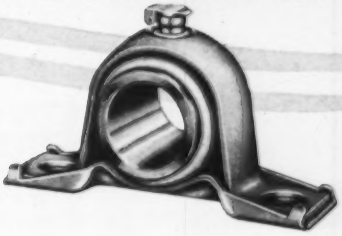

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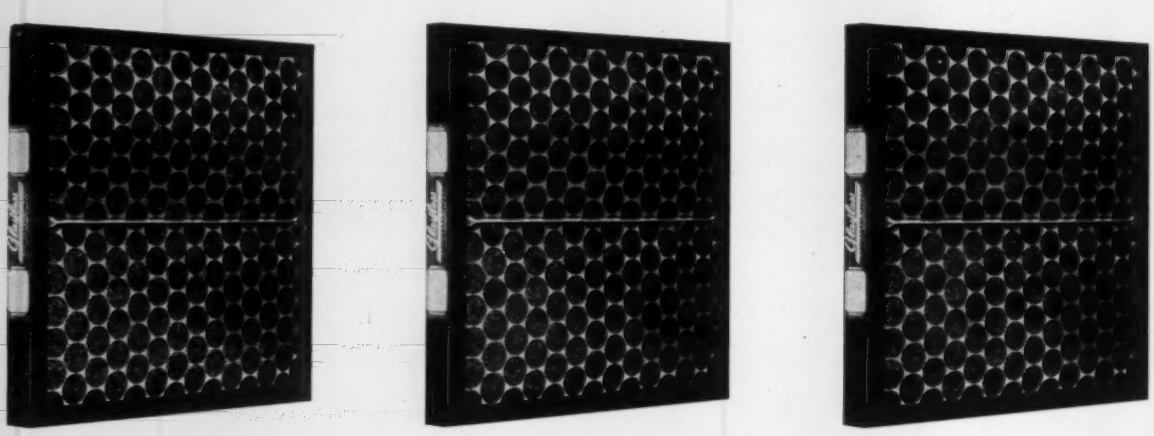

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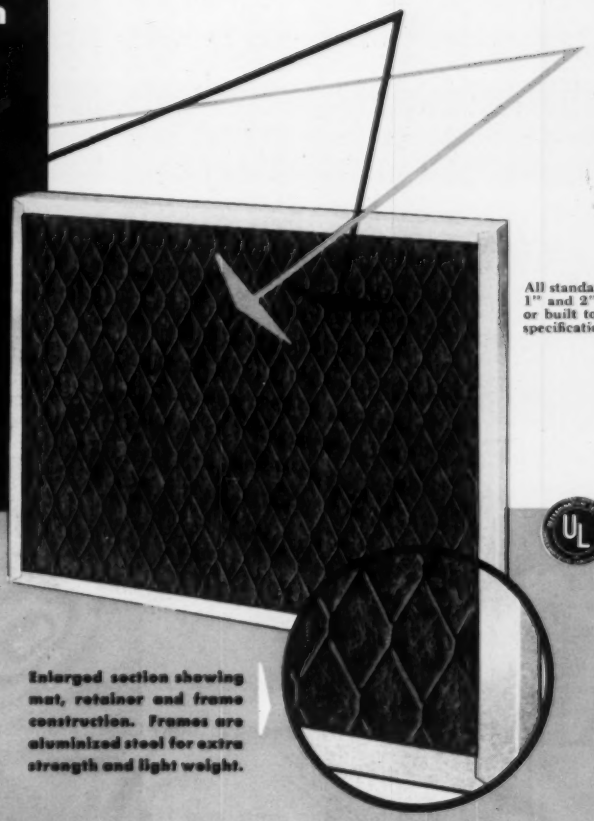

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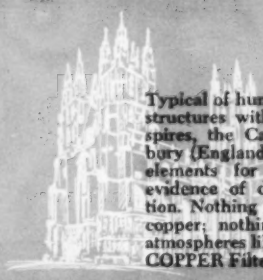

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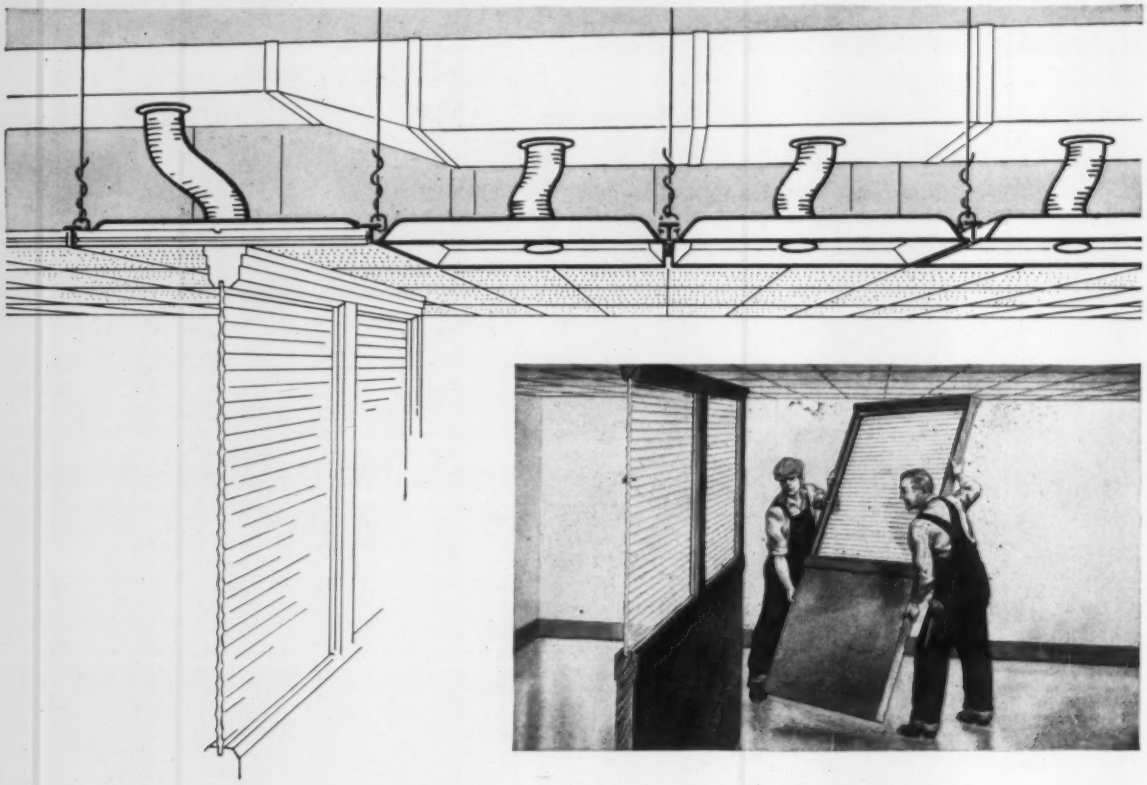

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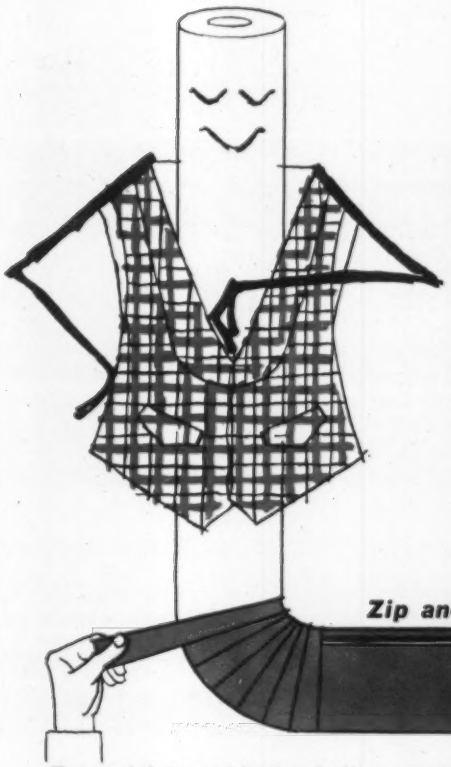

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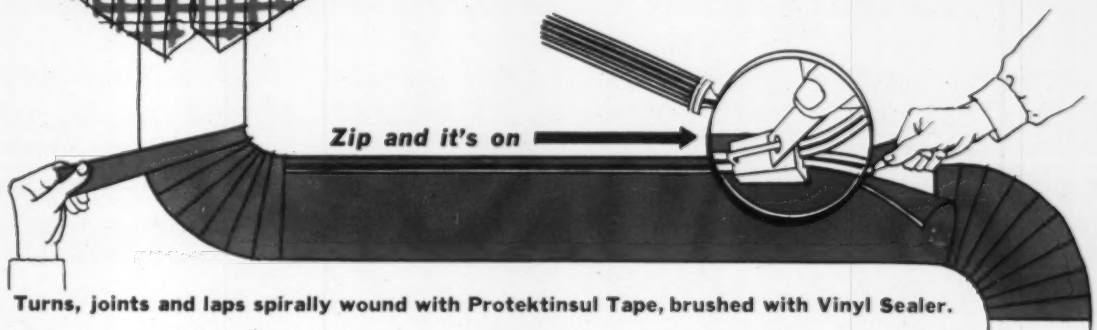

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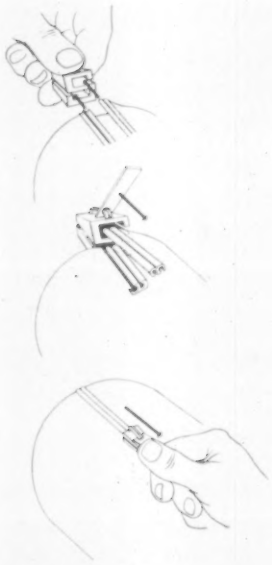

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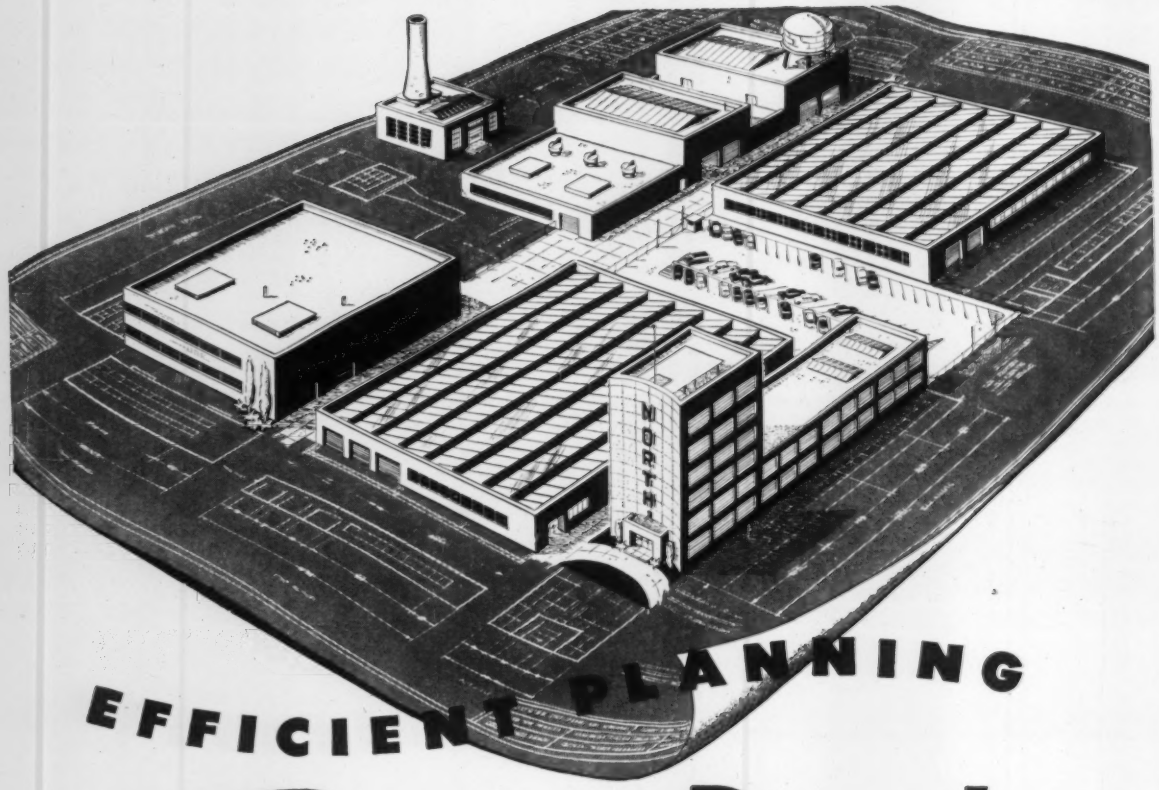

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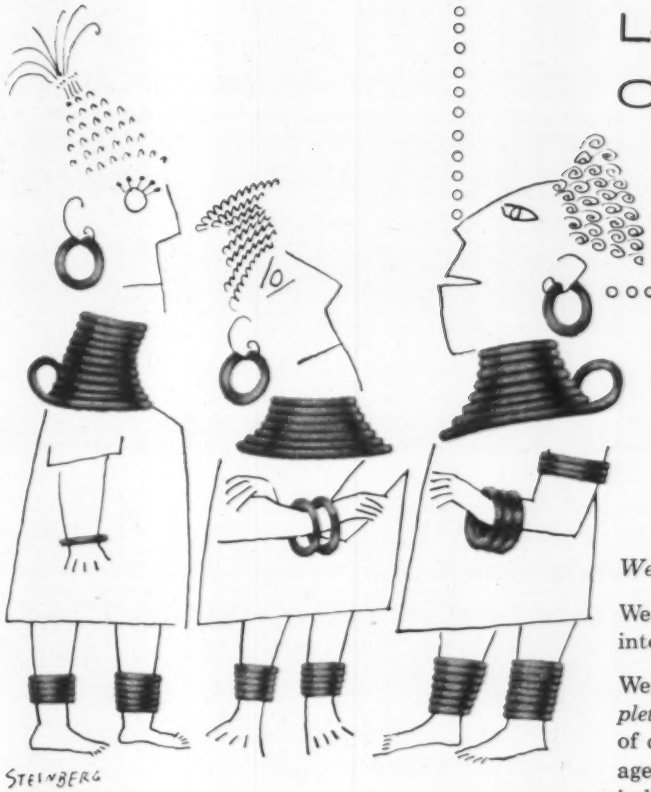

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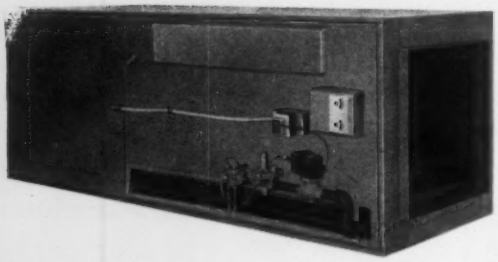

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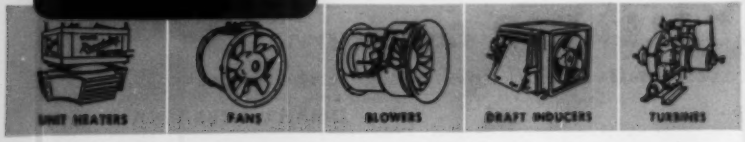

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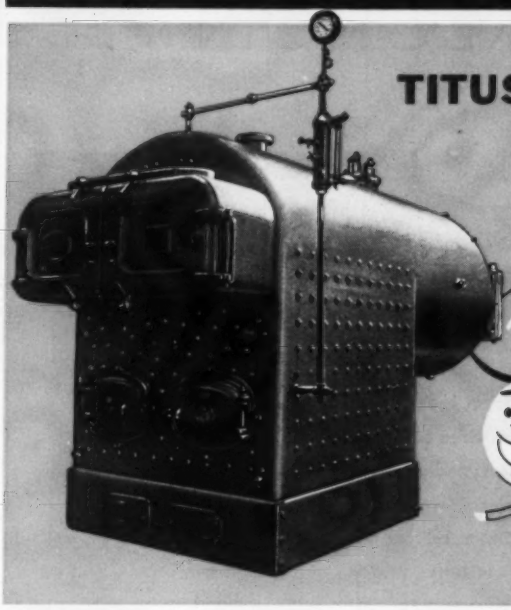

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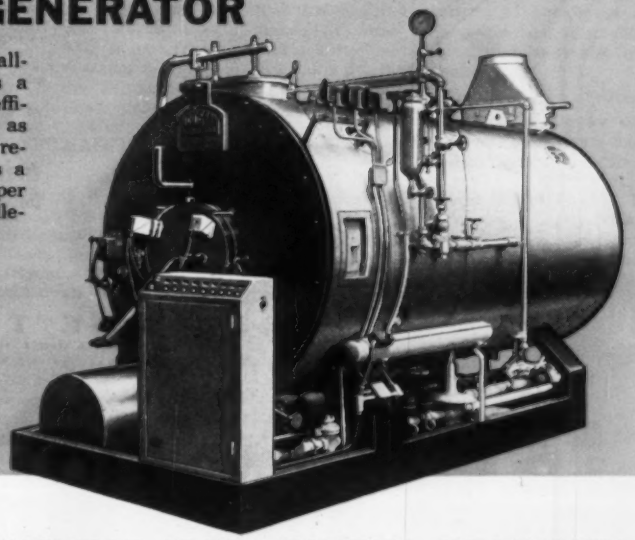

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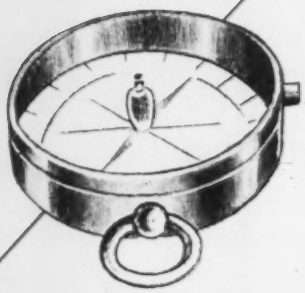

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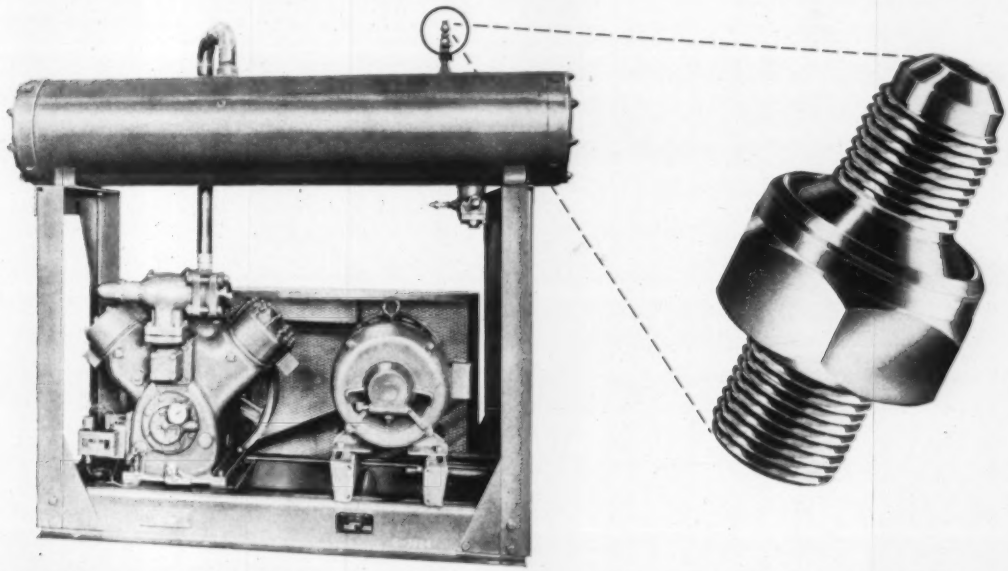

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Pressured Systems

All condenser units must have some kind of a pressure-relief device, it's true. But Worthington Corporation—a leading manufacturer of air conditioning equipment—wants to be *doubly* sure that its units will be safe from the dangers of overpressure under all operating conditions. That is why Worthington air conditioning condenser units are equipped with a *secondary* relief device... the BS&B SEALED TYPE SAFETY HEAD!

This low-priced "throw-away" SAFETY HEAD unit functions much like a fuse in your electrical system... in case of failure or malfunction of the primary relief device, the SAFETY HEAD is there to provide that *extra margin of safety* at a very nominal cost! Factory assembled and sealed, it is guaranteed leak-proof, and consists of a brass fitting containing a fine silver rupture disc which will rupture at a safe predetermined pressure to provide instantaneous and positive pressure relief. It may also be used as a primary relief device.

Thousands of BS&B SEALED TYPE SAFETY HEADS are now in service on many different types of pressured systems and equipment. If you are a manufacturer or user of such equipment, we suggest that you safeguard it with a BS&B SAFETY HEAD – the *non-mechanical* relief device! Available in a variety of types, pressure ratings and connection sizes. Investigate now! Descriptive literature and prices will be sent on request.

EFFICIENCY
OVER 60 YEARS
BS&B
RELIABILITY

CODE ACCEPTED!

BS&B SEALED TYPE SAFETY HEADS comply with the standards established by the ASA B-9 Refrigeration Code, the ASA B-19 1950 Code and the ASME Unfired Pressure Code. Many cities are now requiring that air conditioning and refrigeration equipment be protected with safety devices which will comply with these code requirements.

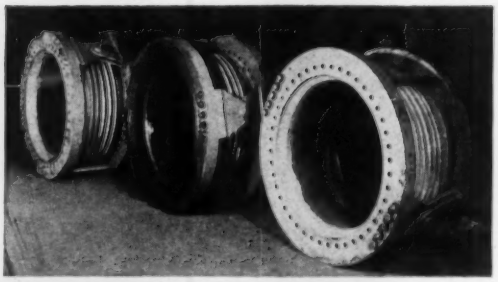
Safety Head Division, Dept. 2-DZ9

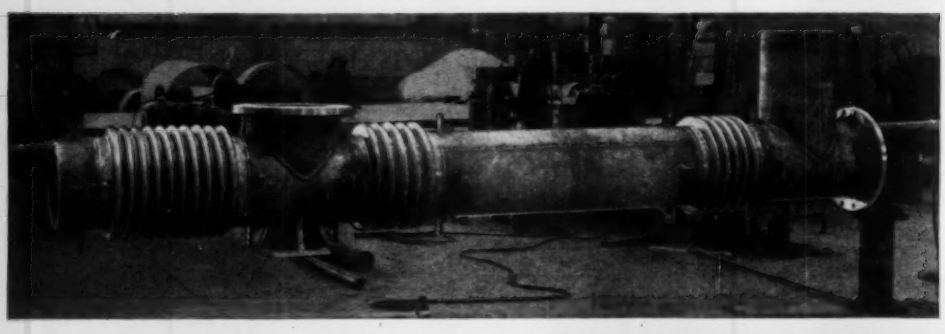
BLACK, SIVALLS & BRYSON, INC.

7500 East 12th Street — Kansas City 26, Missouri

MASSIVE CORRUFLEX HINGE-TYPE EXPANSION JOINTS

These 48" Hinge-Type Corruflex Expansion Joints were manufactured by ADSCO on special order from a processing customer. A hinge joint permits movement of pipe line in one plane by rotating about its own hinge-pin axis. Frequently, Corruflex Hinge Joints are used in groups of three to permit a pipe line to expand in three directions without transmitting line pressure thrust to anchors.



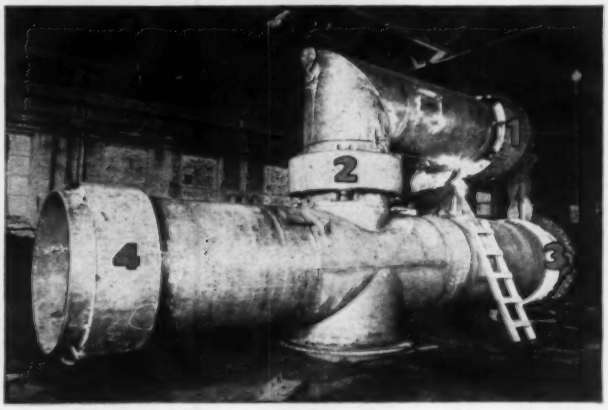


COMPOUND JOINT DOES MANY JOBS

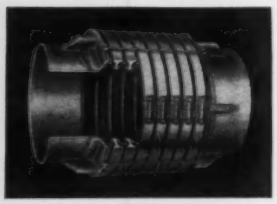
When tie rods, from tee to tee, are placed on this Corruflex joint assembly during installation, four distinct tasks will be performed. (1) The centerline distance between the two vertical outlets will be maintained. (2) Axial expansion between the two tees will be absorbed. (3) All lateral motion developing between the two vertical outlets will be absorbed. (4) And the corrugated section to the left of the anchor point will absorb axial movement of piping.

ADSCO-ENGINEERED TO TAME TURBINE EXHAUST

This fabricated Corruflex assembly is made up of a main exhaust header, 54" in diameter, and a 42" branch. Left end of main header is fixed, while two ends at right are attached to steam ejectors which are moved vertically. Two 42" Anti-Compression Corruflex Joints (hidden by covers at 1 and 2) absorb angular and axial movement. Two Single, Non-Equalizing Corruflex Joints (3 and 4) absorb lateral and axial movement.



PIPE EXPANSION IS A JOINT PROBLEM AT ADSCO



Basic Corruflex Joint

As these jobs illustrate, man-to-man teamwork between ADSCO and its customers is the basis for solving pipe expansion problems. When a problem is presented, ADSCO's Engineering Department applies its background of knowledge and experience to the conditions imposed and invariably develops the right answer. It is an answer which not only makes the customer's piping react the way it should but which also saves money in both installation and maintenance costs...While the joints shown on this page were specially engineered, ADSCO makes a complete line of basic Corruflex joints (left) for less complicated piping problems. Write for Bulletin 35-51.

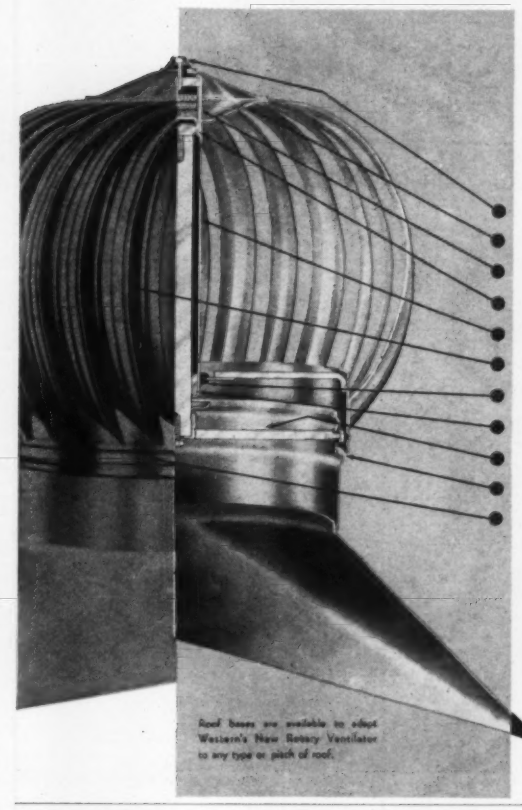
ADSCO ENGINEERED PRODUCTS

AMERICAN DISTRICT STEAM DIVISION

ADSCO INDUSTRIES, INC.

NORTH TONAWANDA, NEW YORK

PLANTS: BUFFALO, N. Y. – NORTH TONAWANDA, N. Y. – RICHMOND, CALIF.



NEW-INSIDE AND OUT

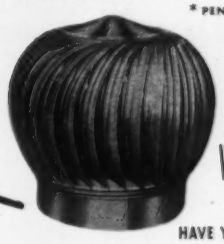
WEMCO'S newly engineered roof ventilator is not only strikingly new in appearance, but look inside, and there too, you will see that Western's Rotary is the newest and best answer to ventilating problems!

LOCKED-ON ROTOR prevents loss or damage in the highest winds, yet the ventilator is easy to disassemble without special tools.
BOX-GIRDER CONSTRUCTION is used for rigidity and permanent alignment.

WOOL-PACKED LUBRICANT RESERVOIR is oversized to ensure years of operation with minimum maintenance, under most severe conditions.
PATENTED* BEARING SUSPENSION — New radial thrust ball-bearing keeps friction loading so low that momentum keeps the head spinning even in sporadic winds.
PERMANENTLY SEALED WEATHERPROOF CASING protects upper and lower bearings from airborne dust and grit.
EXCLUSIVE CORRUGATED VANE DESIGN ensures rigidity, and prevents shipping damage.
SIX RUBBER MOUNTINGS completely isolate head from throat — no noise or vibration can be transmitted.
SINTERED BRONZE RADIAL BEARING is oil-impregnated for minimum friction drag and long operating life.
NEW SUPPORT SPIDER ASSEMBLY—redesigned for greater strength and rigidity.

MINIMUM CLEARANCE BETWEEN BASE AND ROTOR prevents backdrafts or air spillage.
BAKED ENAMEL FINISH in soft sea-green hammertone—blends with any exterior, modern or traditional.

* PENDING



WESTERN ENGINEERING AND MFG. CO. IS THE ONLY MANUFACTURER OF ROTARY VENTILATORS WHO BACKS UP THEIR PRODUCT WITH AN UNCONDITIONAL GUARANTEE. FOR FURTHER INFORMATION ABOUT THIS EXCLUSIVE GUARANTEE, OR FOR THE NAME OF YOUR LOCAL REPRESENTATIVE, WRITE TO:

WESTERN ENGINEERING & MFG. CO.

4116 Ocean Park Ave., Venice, Calif.

HAVE YOU SENT FOR YOUR FREE VENTILATION NOMOGRAM?

Shhhhh . . .

COMPLETE *SILENCE*
FOR YOUR ENTIRE
PIPING SYSTEM
WITH A

MILLER *STREAMFLOW* CHECK VALVE

CENTER GUIDED • SHOCK PROOF • ELIMINATES WATER HAMMER
ENTIRELY *NOISELESS* • FULL RADIAL FLOW
Certified Minimum Pressure Loss Curves Available • Sizes 1" through 24" Flanged • ASA Drilling • IBBM • Cast Steel • All Alloys

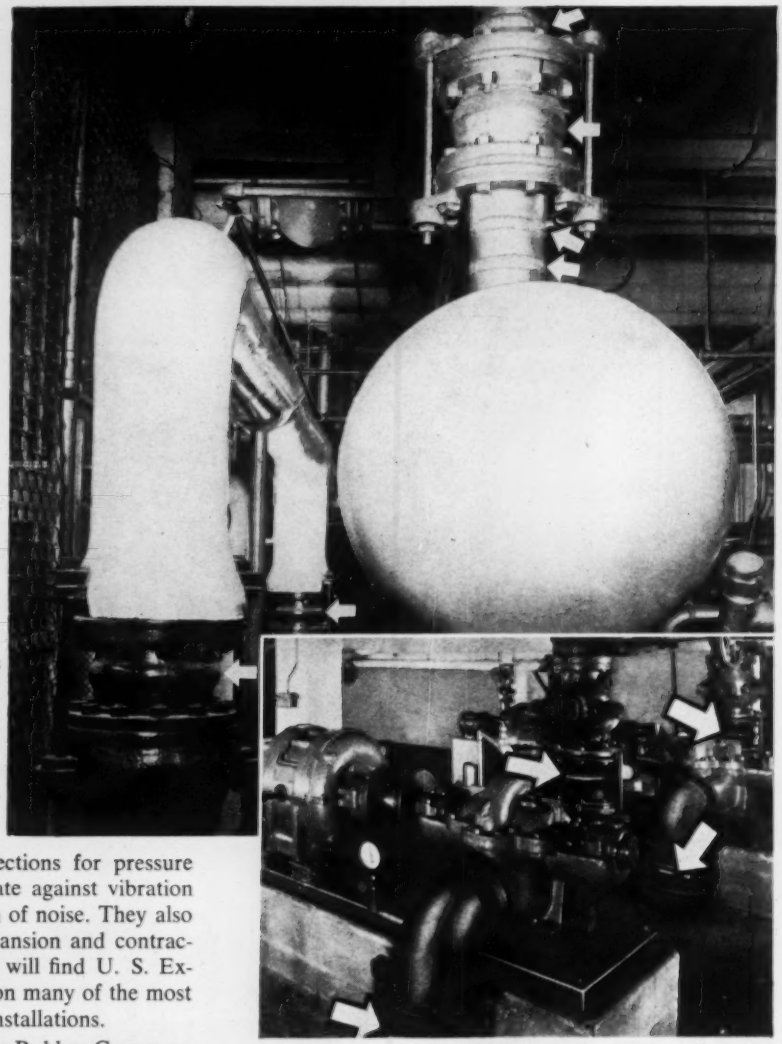
WRITE FOR LATEST CATALOG
AGENTS IN PRINCIPAL CITIES

MILLER VALVE CO. INC.

P.O. BOX 1255 — PITTSBURGH 30, PA.
PLANT — 1620 PENNSYLANIA AVE.

FOR SILENT, VIBRATION-FREE AIR-CONDITIONING SYSTEMS

Prevent transmission of compressor noises in circulating lines with U. S. Rubber Expansion Joints



A compressor with expansion joints on the suction and discharge lines. Suction line is at bottom, discharge line at top. Expansion joints were vulcanized to welded flanges at our factory, to handle Freon in the compressors.

Photo shows expansion joints on the header connections to the condenser and to the cooler and on pipe lines at the circulating water pump.

These flexible rubber connections for pressure and vacuum pipe lines insulate against vibration and prevent the transmission of noise. They also offset stresses caused by expansion and contraction and misalignment. You will find U. S. Expansion Joints are standard on many of the most up-to-date air-conditioning installations.

A product of United States Rubber Company, these U. S. Expansion Joints have many applications in air conditioning: they are used for the chilled-water lines from the water chillers, and the refrigerant lines from the refrigerating compressors; also the water lines to and from the cooling towers. They are used on the header connections to the condenser and to the cooler and on pipe lines at the circulating water pump.

For handling Freon in compressors, there is a specially-designed U. S. Freon Expansion Joint.

Since they have no moving parts to wear or bind, U. S. Expansion Joints last a long time. Some are still in service after 30 years—a record unmatched by any other expansion joint! U. S. Expansion Joints will solve any pipe line problem caused by noise, vibration and misalignment. They are obtainable at any of the 27 "U. S." District Sales Offices, or write address below.

"U. S." Research perfects it..."U. S." Production builds it...U. S. Industry depends on it.

UNITED STATES RUBBER COMPANY

MECHANICAL GOODS DIVISION · ROCKEFELLER CENTER, NEW YORK 20, N. Y.

Hose • Belting • Expansion Joints • Rubber-to-metal Products • Oil Field Specialties • Plastic Pipe and Fittings • Grinding Wheels • Packings • Tapes Molded and Extruded Rubber and Plastic Products • Protective Linings and Coatings • Conductive Rubber • Adhesives • Roll Coverings • Mats and Matting

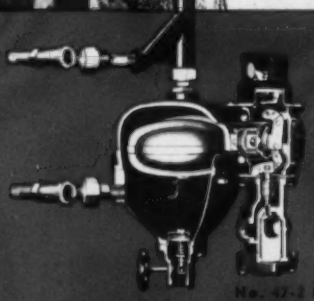
Don't let the gauge glass fool you...

That's a steam boiler all right in the picture above. The gauge glass gives it away.

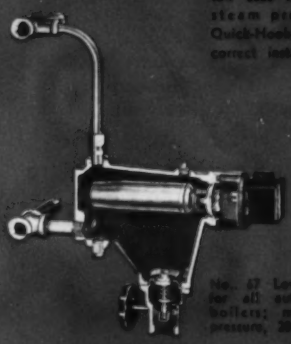
But to call attention to the perils of low water, Sam could be looking at a hot water boiler just as well.

Both steam boilers and hot water boilers are in the same boat when it comes to low water and the troubles and expense it can cause. True, the need was recognized with steam boilers first. But today many insurance companies, local codes and federal specifications insist on the same kind of protection for hot water heating boilers.

The best answer in either case is a McDonnell Feeder Cut-off Combination. To learn all the facts about low water in hot water boilers write for copy of new folder on "Basic Safety Controls for Hot Water Space Heating Boilers".



No. 47-1 Feeder-Cut-off Combination for boilers below 9000 sq. ft.; maximum steam pressure, 25 lbs. Quick-Hook-Up for speedy, correct installation.



No. 47 Low Water Cut-off for all automatically fired boilers; maximum steam pressure, 30 lbs.

No. 150 Water Level Control for boilers of any size with steam pressures up to 150 lbs. Used as feed-pump control, low-water fuel cut-off, low-water alarm switch, or any combination of these functions.

McDONNELL & MILLER, Inc.

3500 N. Spaulding Ave., Chicago 18, Ill.

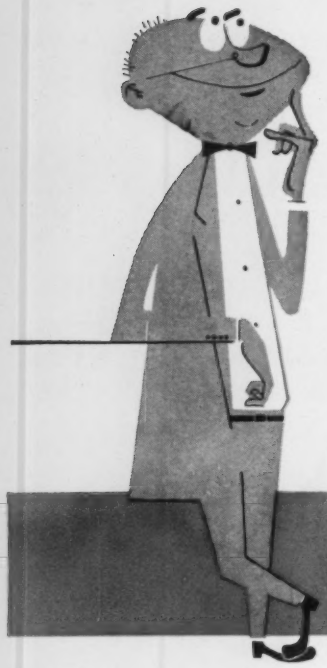
Doing One Thing Well

Your Jobber

McDONNELL

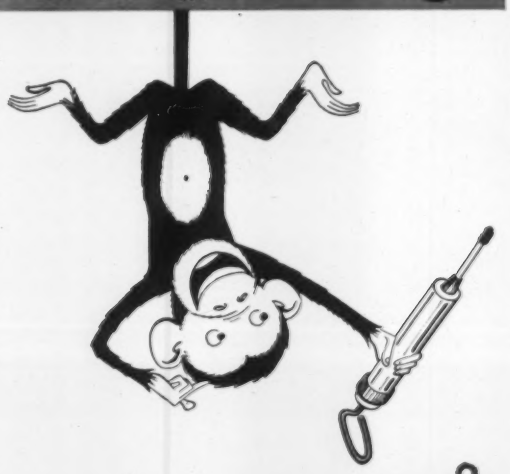
Boiler Water Level Controls

BEARING TROUBLES?

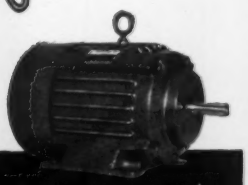


NO SIR! Not with new Reliance Motors and METERMATIC .... the

Automatic Grease Monkey



I found out how to put an end to burned out bearings from the Reliance Metermatic Bulletin, A-2406. Why don't you write for one? A-1499

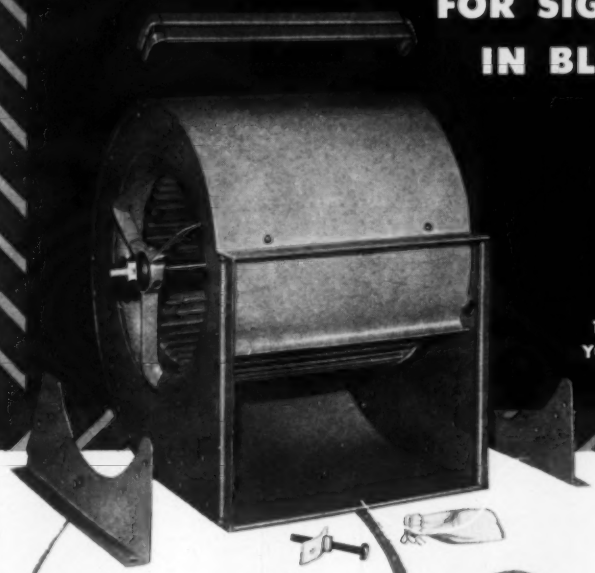


RELIANCE ELECTRIC AND ENGINEERING CO.

Cleveland 10, Ohio • Offices in Principal Cities

LEADERS RELY ON LAU

FOR SIGNIFICANT ADVANCES IN BLOWER ENGINEERING



Lau Series "A" Econo-Pak Blower

THIS COMPLETE PACKAGE CAN REDUCE YOUR BLOWER INVENTORY UP TO 50%

Put your Problems up to Lau

Write **Lau** today for complete specifications, technical data, and **Lau** Blower Catalog 707-25-26.

The popular **Econo-Pak** eliminates special Blowers for each application, simplifies order procedures, lowers your handling and shipping costs, and reduces warehouse space 26½%. You eliminate slow-moving stocks, and this **one** Blower (available in three basic sizes, each in two widths) covers 95% of Blower applications for residential air-moving equipment. **Sample to prove our points offered to recognized companies.** Check these features—then act:

Has all features of **Lau** standard Series "A" Blowers, yet effects savings up to 10% per unit. Two housing supports and motor mount bracket not attached to unit, but included in package with all necessary hardware. Angle of discharge can be quickly adjusted to any one of **five** positions. Use of exclusive **Lau-Pak** bearings, without oil cups and needing no lubrication, enables adjustment of discharge angle without oil cup problem. Replaces expensive inventories of many unassembled parts . . . or gives you flexible stock of blowers suitable for many applications **with minimum labor. You can now handle model changes while in production.**

LB-3-55

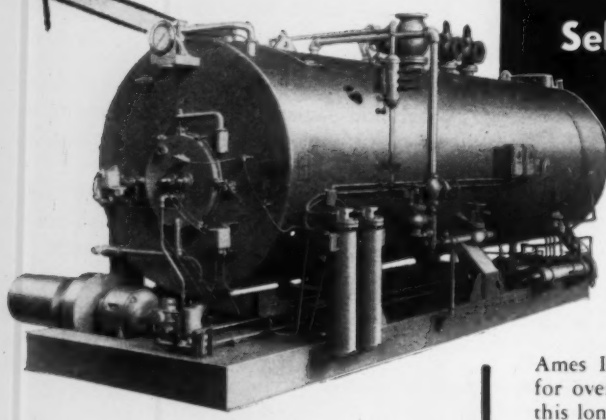
THE LAU BLOWER COMPANY • 2112 Home Avenue, Dayton 7, Ohio

In Canada • The Lau Blower Company of Canada, Ltd., Kitchener, Ont., Canada

LAU World's Largest Manufacturer of Air Conditioning Blowers

SO YOU HAVE TO BUY A BOILER!

Select an AMESTEAM GENERATOR and solve all your problems



You don't have to dig through mountains of data to pick the boiler that will give your company the most economical and satisfactory service! It's more a question of *where* you buy it than what boiler you choose. What's the maker's reputation?

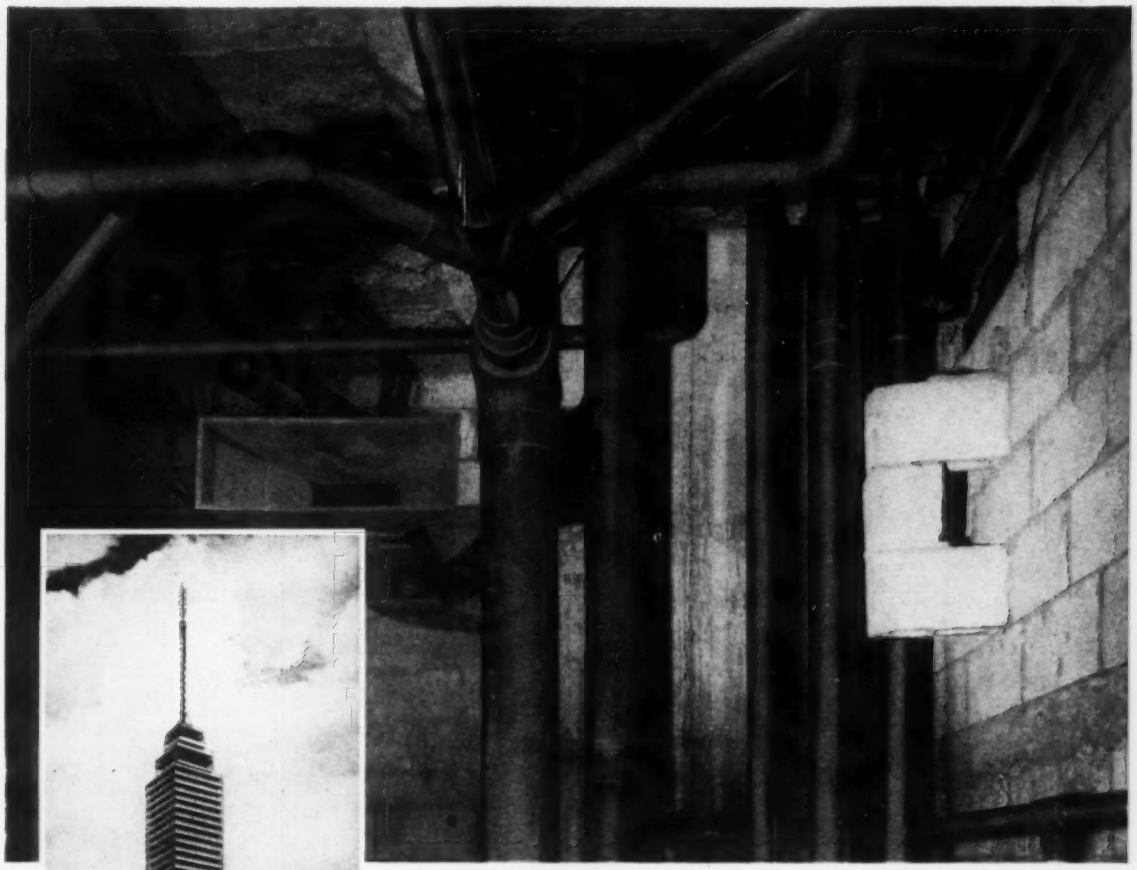
Ames Iron Works have been building boilers of quality for over 100 years. Back of every Amesteam Generator is this long, successful experience — represented by the Ames Engineering Staff, a large group of skilled boiler makers and an efficient, nation-wide sales and service organization at your disposal. Yes, quality and experience *do* count — and the thousands of Amesteam Generators giving dependable, low-cost service in power, process and heating applications are proof of it. Why not be *sure* by specifying Amesteam Generator? Write today for details and name of your Ames representative.

AMESTEAM GENERATOR

- 80% guaranteed thermal efficiency.
- Single economical package purchase.
- Package installation economy.
- Completely safeguarded.
- Easy, inexpensive maintenance.
- 20 sizes, 10 to 600 H.P., 15 to 200# W.P., oil, gas or oil-gas combinations with quick fuel switchover feature.

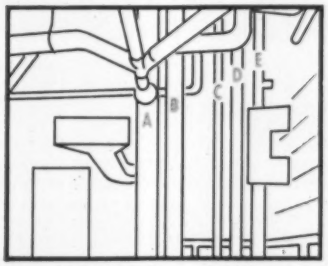
AMES IRON WORKS, INC.

BOX D-95, OSWEGO, N. Y.



Main pipe shaft. Note compact assembly made possible by the trim, space-saving copper tube and fittings. See pipe sizing diagram below, left.

Mexico's newest and tallest skyscraper. General Director: Adolfo Zeevaert, C. E. Constructed by the Engineering Department of "La Latino Americana, Seguros de Vida, S. A." Plumbing contractor, Técnica, S. A.



A. 8" soil stack. B. 6" vent. C. 3" hot water. D. 4" cold water. E. 3" waste for future use. Laterals to soil stack are 4". All sanitary drainage lines are Type M.

43-Story all-copper plumbing... in Mexico's tallest building

COPPER hot and cold water lines
sanitary drainage system
roof drainage lines

100,000 pounds of copper tube, Types K, L and M, provide lasting protection against rust in the plumbing system of this beautiful, ultra-modern office building of the Latino Americana Insurance Company, Mexico City. Tube sizes ranged from ½" to 12" incl. Anaconda tube was used throughout, with Nacional de Cobre of Mexico furnishing the smaller sizes.

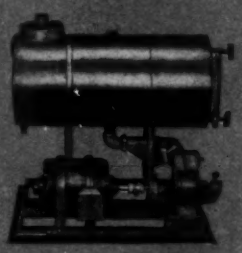
For a skyscraper or a small home, copper tube plumbing saves installation time and effort... often the over-all cost is less. Its light weight makes it easy to handle. Standard 20' lengths eliminate many joints. Assembly work with solder-type fittings is quickly and easily accomplished.

For economical, non-rusting plumbing specify ANACONDA Copper Tubes and ANACONDA Solder-Type Fittings. A wide range of sizes are stocked by Anaconda distributors throughout the country. Descriptive literature is available. Write to *The American Brass Company, Waterbury 20, Conn.* In Canada: *Anaconda American Brass Ltd., New Toronto, Ontario.* 5211

for copper tubes see your

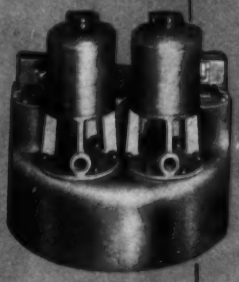
ANACONDA®

distributor



"TM" TURBINE PUMP
Designed for boilers up to 250 hp and discharge pressures up to 150 lbs.

"UV" CONDENSATE PUMP
Capacities ranging from 2,000 to 40,000 sq. ft. EDR, and discharge pressures from 10 to 75 lbs.

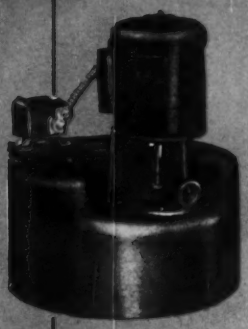


"CV" VERTICAL PUMP
Heavy duty duplex unit with two float switches. Capacities ranging from 500 to 10,000 sq. ft. EDR and discharge pressures from 10 to 20 lbs.

Skidmore Pumps

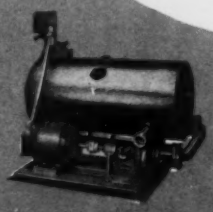
PEAK EFFICIENCY

. . . AT LOW COST!

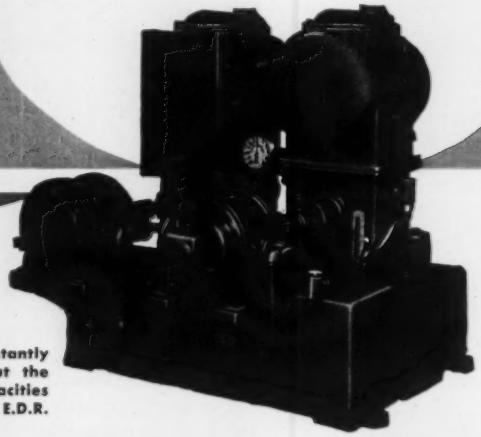


"CV" VERTICAL PUMP
Capacities ranging from 500 to 10,000 sq. ft. EDR and pressures from 10 to 20 lbs.

Famous for their efficiency—means low installation cost, as well as low operating cost.



"HS" CONDENSATE PUMP
Capacities ranging from 1,000 to 65,000 sq. ft. EDR and discharge pressures from 10 to 75 lbs.



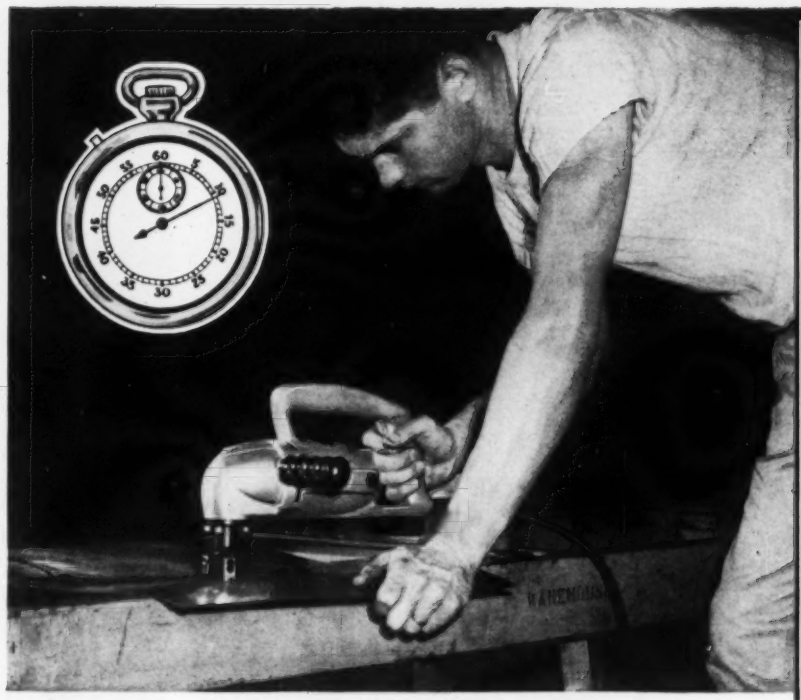
SKIDMORE VACUUM PUMP
Like all Skidmore Pumps it has constantly maintained the leadership throughout the years in capacity and efficiency. Capacities ranging from 5,000 to 100,000 sq. ft. E.D.R.

Write for bulletins or contact the nearest Skidmore representative for complete engineering data.

SKIDMORE PUMPS

Skidmore has been Synonymous with Quality and Engineering Leadership, Since 1921.

SKIDMORE CORPORATION • ST. JOSEPH, MICHIGAN



New SKIL Shear Sweeps Field in Actual Comparison Tests!

SKIL Model 231 Wins 5 Trials Out of 5
Outperforms, Outproduces All Others

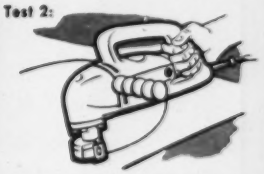
Actual tests prove what many sheet metal men are learning for themselves. The new SKIL 231 Shear is far superior to all others on the market. These tests show the speed, power, and control that are making the SKIL Shear so popular on every job . . . in every shop.

Here are actual results of impartial tests of the SKIL Model 231 Shear and competitive brands. Shown are performance figures for SKIL, Brand A, and Brand B.

Test 1:

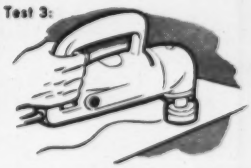
25" Trial Cut of 12 Gauge Metal
Model 231.....9.2 seconds
Brand A.....15.3 seconds
Brand B.....12.0 seconds

Test 2:



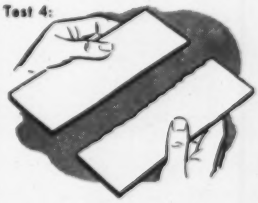
Cutting Right and Left Hand Circles
Model 231.....22.0 seconds
Brand A.....24.0 seconds
Brand B.....22.2 seconds

Test 3:



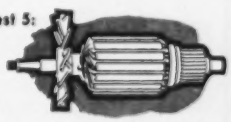
Small Diameter of Circular Cuts
Model 231.....1½"
Brand A.....2"
Brand B.....(right hand) 2½"
(left hand) 4½"

Test 4:



Cleanness of Cuts
Model 231.....Excellent
Brand A.....Good
Brand B.....Poor

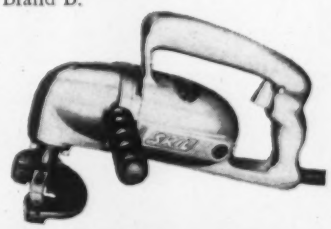
Test 5:



Power and Performance
SKIL 40% more powerful than Brand A and 33⅓% more powerful than Brand B.

SKIL SHEAR 231—Best All-Around

The results show that the 231 is the best all-around Shear on the market today. Faster, easier handling, more powerful! Features like the Contour Grip Handle at the rear of the tool make it a favorite with workmen who have tough cutting to do. Improved foot design keeps maintenance costs down for job superintendents. This is the shear you need in *your* shop. The SKIL Model 231.



FREE! Mail the Coupon for a Demonstration and a FREE Trial of the SKIL SHEAR Model 231! See How Much Faster, Easier-Handling this New SKIL Shear is on your Toughest Cutting Job!

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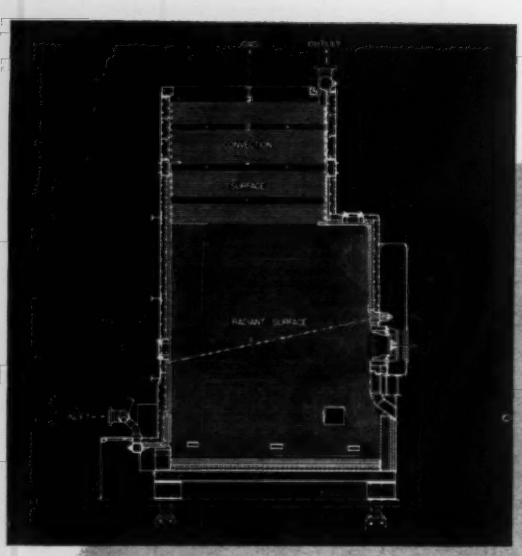

The New C-E La Mont Controlled Circulation Hot Water Boiler

For those applications where high-temperature water has advantages over steam — and there are many — this boiler has many special features such as:

1. **Complete control** over water movement in both system and boiler.
2. **Low pressure loss** makes separate boiler pump unnecessary.
3. **Pressurized operation** with oil or gas means no induced draft fan — simple stack.
4. **Single-pass design** — no baffles . . . low draft loss . . . cleaner boiler.
5. **Other features** such as: steel enclosed setting — few headers, all accessible — any fuel, oil, gas or coal.

Sizes from 15 to 150-million BTU per hour, or more — pressures to 300 psi — temperatures to about 425 F.

MEET YOUR HEATING or PROCESS NEEDS WITH ONE OF THESE C-E BOILERS

If you need steam — from 4,000 to 60,000 pounds per hour . . . or high-temperature water for heating or process applications . . . one of the three C-E Boilers shown here will fit your needs exactly.

Collectively they offer an exceptional diversity of choice, and a brief consideration of the features of each will help to "pin point" the design characteristics suited to your situation.

Of course, if larger capacities are needed the Combustion line includes boilers of any capacity — for any pressure — for any fuel or method of firing.

Please feel free to call upon us for further detailed information. Catalogs of each of the units illustrated are available upon request.

B-8208

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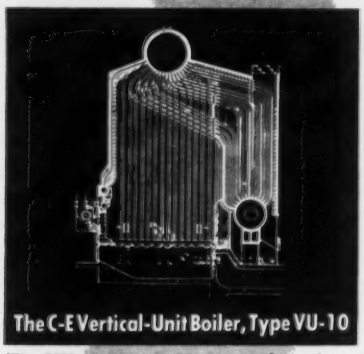
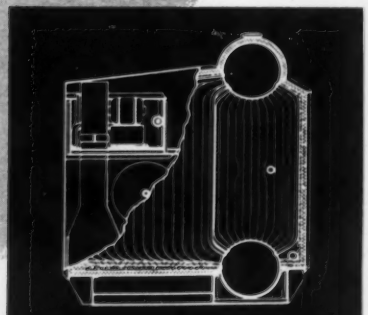


The C-E Vertical-Unit Boiler, Type VU-10

The VU-10 is available in nine sizes from 10,000 to 60,000 pounds of steam per hour . . . for design pressures up to 475 psi . . . up to 200 degrees of superheat available in 20,000-60,000 lb range . . . for solid, liquid, or gaseous fuels. A completely standardized design adaptable to many conditions and particularly well suited to plants having small operating and maintenance forces. It performs efficiently over a wide range of output, and is easy to operate and to maintain.



The C-E Package Boiler, Type VP

This shop-assembled boiler is available in fourteen sizes from 4,000 to 42,000 pounds of steam per hour . . . for design pressures up to 500 psi . . . up to 200 degrees of superheat available in sizes above 21,000 pounds capacity . . . for pressure firing of liquid or gaseous fuels. The VP Boiler has more water-cooled area per cubic foot of furnace volume than any other boiler of its type. The VP is enclosed in a reinforced, gastight, welded steel casing, and shipped completely assembled with firing equipment, fittings and forced draft fan. For foundation, it needs only a simple concrete slab.

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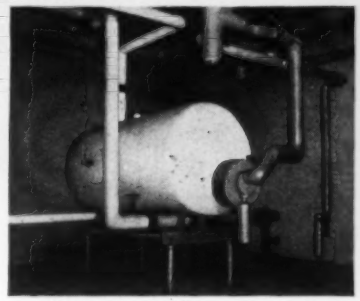
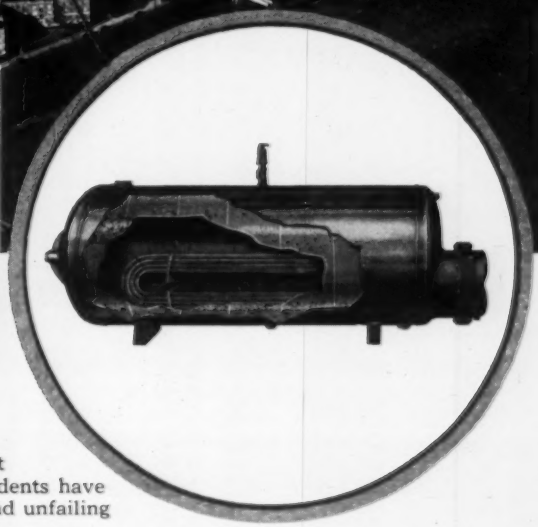
look for the

Copper Lining

they did at
BOSTON'S OLD HARBOR HOUSING PROJECT





Old Harbor Housing Project in Boston, Mass. p-k copper-lined water heaters were installed by the M. Ahern Company, Plumbing Contractor.

In January 1937, 31 p-k copper-lined water heaters were installed at Boston's Old Harbor Housing Project. For the past 17 years, thousands of Old Harbor residents have enjoyed the benefits of an adequate and unfailing source of rust-free hot water.

Maintenance is just routine. These copper-lined heaters need no pampering. They just keep everlastingly at it. Recent inspection showed that the copper shells are still in excellent condition and are expected to stay that way for another 20 years and more.

p-k copper-lined water heaters consist of a complete copper heater built inside of a heavy steel shell—combining the non-corrosive qualities of copper with the superior strength of steel.

For trouble-free, rust-free hot water—year after year—

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Of course, the former NEMA frame sizes 66 to 505 (1/3 to 150 H.P.), incorporating the latest advances in motor design, will remain in production.

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FIRST . . . FOR MOTORS . . . DRIVES . . . GRINDERS

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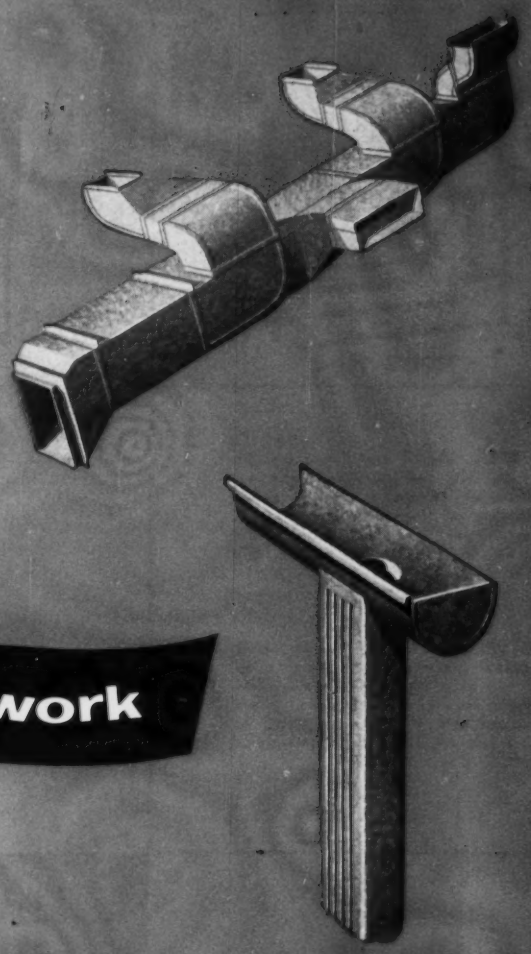
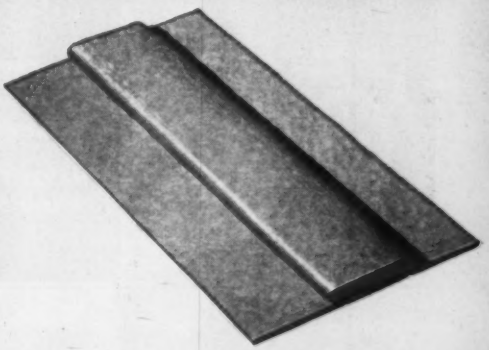


Wherever a durable zinc-coated material is needed for sheet metal fabrication, there's nothing better than Weirkote. Gutters, downspouts, ducts—no matter what the application, the name Weirkote on galvanized steel means uniformly high quality steel, tightly coated with zinc to resist cracking, peeling, flaking and corrosion. The high quality is assured by Weirton's modern mills and methods —and men.

When your specifications call for galvanized steel, call Weirton, and be sure.

Weirkote is available in coils and cut lengths: gauges 16 to 30 inclusive. Maximum width—42″, maximum cut length—168″. Weirkote can be obtained to fit any customer requirement. For standard roofing and siding it is guaranteed to conform to A.S.T.M. specification A361-52T.



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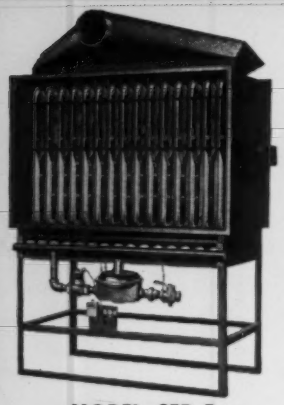
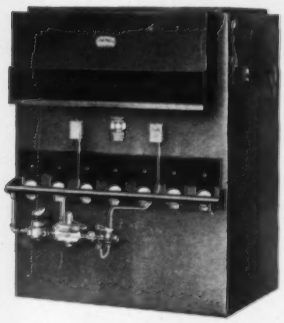


MODEL SED-E

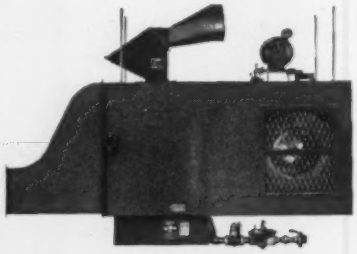
MODEL SED-S



MODEL SED-VF

MODEL SED-E — Non-corrosive type 321 stainless steel heat exchanger. Permits installation downstream of cooling equipment, for continuous blower operation. Air throughput in either direction. 80,000 to 600,000 Btu input.

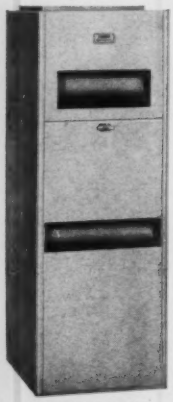
MODEL SED-S — Same as SED-E except controls are at the side, instead of at the end where accessibility requires either SED-E or SED-S is available in sizes from 80,000 to 600,000 Btu input in increments of 40,000 Btu.



MODEL SEU

MODEL SED-VF — Tested and approved as a duct furnace; type 321 stainless steel. Re-circulated or fresh air enters through bottom, sides, or back. Built-in air bypass, vent in front. Sizes from 70,000 to 245,000 Btu input.

MODEL SEU — Suspended unit heater. Recirculates room air. Diffuser outlet with adjustable vertical and horizontal vanes. Double inlet forward curve blower. Continuous duty, variable pitch drives, raised port burners. 80,000 to 600,000 Btu input.



MODEL SEC

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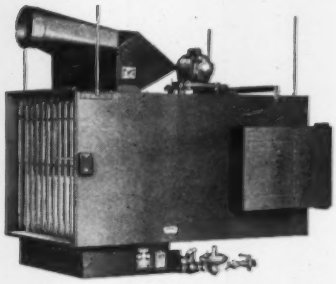

MODEL SES

MODEL SEC — Forced air furnace. Stainless steel heat exchanger sections seam and arc welded. One piece cast iron burners with drilled ports. Oversize double inlet blower, glass or washable filters. 6 sizes — 70,000 to 245,000 Btu input. For zero clearance.

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MODEL SES—Forced air, suspended furnace for installation in suspended duct system. Inlet and outlet designed for sheet metal duct connection. Double inlet forward curved blower. Continuous duty variable pitch drives, raised port burners.

CLEAN AIR ELECTRONICALLY

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• Eliminate SMOKE, AIRBORNE DUST, POLLEN

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Give your plant tested, economical clean air protection.

Unclean Air

Mechanically Clean Air

Electronically Clean Air

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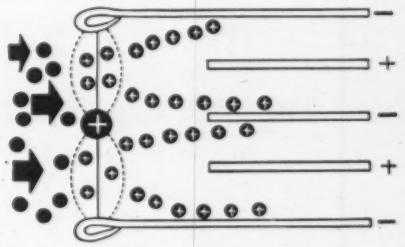
for complete information

Based upon the principle of "electrostatic precipitation," the Electro-Staynew Precipitator charges the dust particles positively (+) as they enter the unit. The particles are then attracted to and held by the negatively (−) charged collector plates as shown in the diagram below.



By this method, the Electro-Staynew removes dust, smoke, soot, and microscopic particles (as small as 1/250,000 of an inch in diameter) from the air with higher efficiency and lower maintenance cost than is possible with any other type of filter. In addition, this new Electro-Staynew Precipitator has unit construction—ionizing and collecting chambers are in one compact unit.

The simple unit construction of the Electro-Staynew gives it unusual flexibility. Combinations of the two basic cell sizes make possible complete installations of any desired capacity. This feature saves time in assembly and simplifies installation. The lightweight construction permits overhead mounting where necessary.

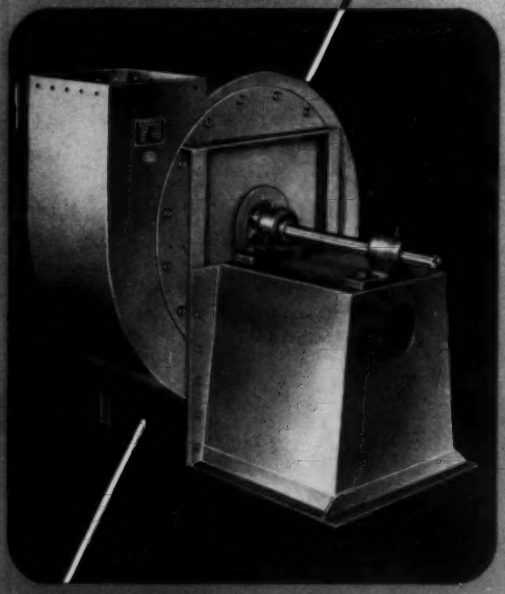
The Electro-Staynew Precipitator can improve the efficiency of your workers, the quality-control of your products; and its extremely low maintenance cost makes operation economical.

DOLLINGER PRECIPITATOR ELECTRO-STAYNEW

DOLLINGER CORPORATION 9 Centre Park • Rochester 3, N. Y.

ALL TYPES OF FILTERS FOR EVERY INDUSTRIAL NEED

ALADDIN FANS



Type "EX" INDUSTRIAL EXHAUSTERS

- RUGGED
- EFFICIENT
- DEPENDABLE

ALADDIN Industrial Exhaust Fans are ruggedly built and are especially suited for material handling or fume exhaust applications. They are ideal for removing dust from grinding wheels, conveying materials such as grains, shavings, sawdust, or the removing or handling of fumes, hot air or gases.

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IN BOTH "SLANT-FIN" AND "SQUARE-FIN" RADIATORS

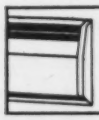
1 **BETTER FIT OF FIN TO PIPE.** With exclusive equipment designed by Slant-Fin engineers, pipe is forced through undersize hole in fins under tons of hydraulic pressure. No weakening of pipe walls by expanding pipe or by fins cutting into pipe surface. The result is the **strongest mechanical union of pipe and fin.**

2 **PERFECT THERMAL BONDING.** On a special machine, standard pipe is rolled to uniform, absolutely round diameter. Wide flanges of fins press solidly against entire surface of pipe for **highest heat transfer efficiency.**

3 **PRECISION SPACING AND EXTRA STRENGTH.** For the flanges of the fins, Slant-Fin devoted much time to experimental engineering. Because of the uniformity of the flanges and their interlocking features, the **fins fit tightly one into another.**

4 **MORE EFFICIENT AIR CIRCULATION.** Because of the increased surface, **fewer** of the distinctive "V" shaped **slant fins** than the traditional square fins can furnish the same radiation per linear foot of pipe. Therefore, fins can be wider apart and a greater volume of air flows more freely.

5 **NO SNAPPING — NO BUCKLING OF FINS.** Because of the **patented notched flange,** the slant-fin can expand and contract without disturbing the bond to the pipe, even under high steam pressures. The result is a radiator that is trouble-free and **noiseless.**



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For Steam or Hot Water.
Choice of 3 Heating Elements
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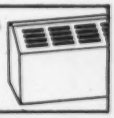
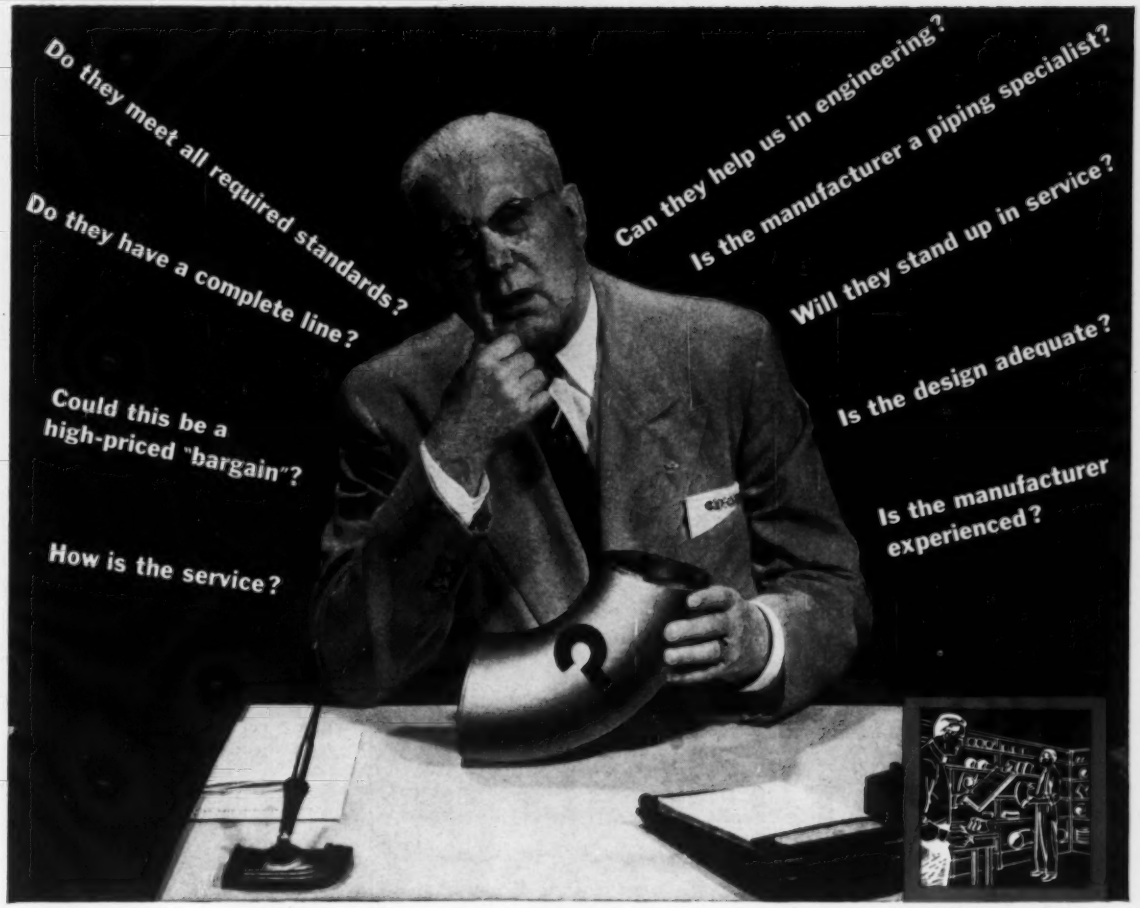


CATALOG No. 505 gives details on the complete line of "Slant-Fin" and "Square-Fin" radiators and enclosures for commercial and industrial applications. BULLETIN No. R-602 supplies facts about residential baseboard heating. Write for your copy.

SLANT-FIN RADIATOR CORPORATION
87-65 130th Street, Richmond Hill 18, New York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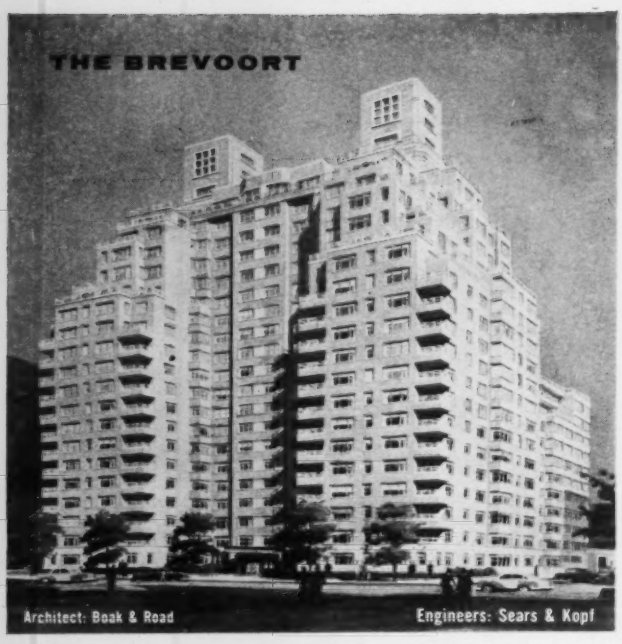

Near Washington Square, in New York City, on the site once occupied by Mark Twain's residence and the fashionable Brevoort Hotel, is the new Brevoort. Completely modern in every respect, it is a fitting successor in the same traditions of the old hotel that attracted so many famous persons.

Fifth Avenue's distinguished new apartment

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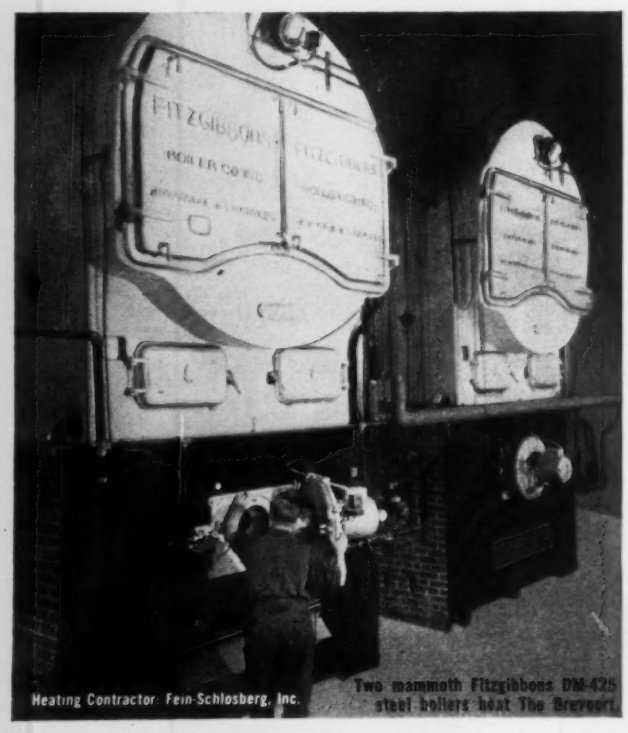

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"We have had excellent results with Fitzgibbons steel boilers for more than twenty-five years. We know they are dependable and will operate at lowest cost, both for fuel and maintenance. And we like the help we get from Fitzgibbons on a new building job. Their engineering representatives work closely with us from the planning stage until the boilers begin operating".

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The Fitzgibbons Boiler®

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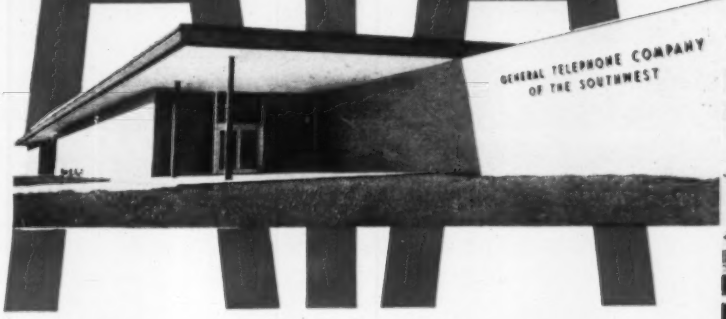

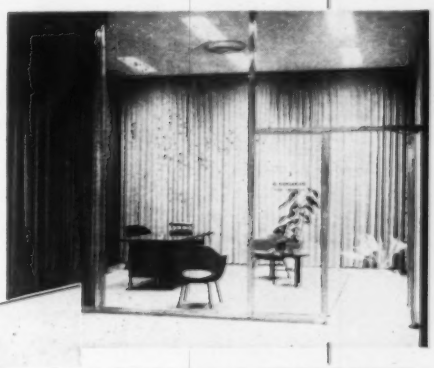

kno-draft air diffusers

Architect: PACE Associates
General Contractor: Evans & Taylor
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In Kno-Draft you have true functional beauty—clean, simple lines in spun aluminum, handsome in its own right or when painted to blend into the ceiling—combined with a high diffusion efficiency that means ideal comfort.

And with Kno-Draft, the volume and pattern of air flow can be accurately adjusted *after* installation—assuring *uniform temperature without drafts* throughout the area and saving a lot of preliminary slide-rule figuring.

There are round, square and slot-type Kno-Draft Air Diffusers to meet all architectural requirements. For complete specifications, send for the Kno-Draft Data Book. Connor Engineering Corporation, Dept. G-95, Danbury, Connecticut.

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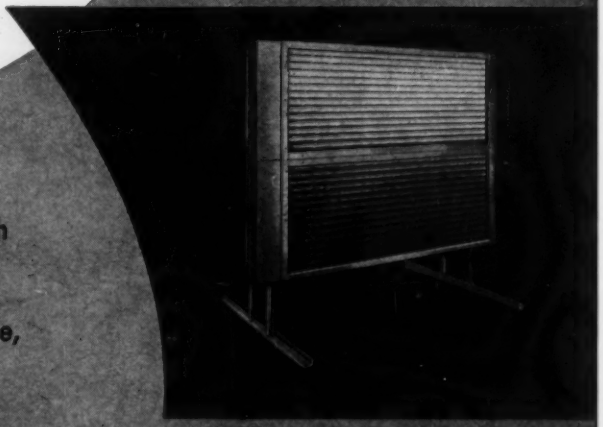

Eliminate all water problems with UNICON by KRAMER. Any size compressor, regardless of tonnage, can be air-cooled with UNICON.

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Stands, hoods, and wind deflectors are available for simplified outside mounting

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FAST FACTS ABOUT genetron® Super-Dry Refrigerants

"Genetron" *Super-Dry* Refrigerants are made by General Chemical Division, Allied Chemical & Dye Corporation, one of America's great producers of industrial and scientific chemicals for more than 50 years. Long a leader in fluorine chemistry, General has the mines, resources, reserves, experience and production facilities that make it a reliable source of fluorinated hydrocarbon refrigerants.

Careful control in the manufacture of "Genetron" refrigerants guarantees products of the highest quality, extremely low in moisture and other impurities. "Genetron" Refrigerants are identical and interchangeable in all respects with comparable fluorinated hydrocarbon refrigerants produced by any other manufacturer meeting the same high quality refrigerant standards and specifications. They have been tested exhaustively by major manufacturers and are being used in their air conditioning and refrigeration equipment.

- **Guaranteed: Exceptionally low moisture content**
- **Non-corrosive to standard equipment materials**
- **Non-toxic, non-flammable, stable, safe**
- **Critical and freezing points well outside range of operating uses**
- **Solvent action on oil helps prevent solidification or congealing of lubricant**
- **Miscible with oil; aid in lubrication of equipment**

genetron 11 ORANGE LABEL — Trichloromonofluoromethane

genetron 12 WHITE LABEL — Dichlorodifluoromethane

genetron 141 GREEN LABEL — Monochlorodifluoromethane

Selected Physical Data

	CCl_3F	CCl_2F_2	$CHClF_2$
Chemical Formula			
Molecular Weight	137.4	120.9	86.5
Boiling Pt. (°F) at 1 Atmosphere Pressure	74.7	−21.6	−41.4
Evaporator Pressure at 5°F (p.s.i. absolute)	2.93	26.52	43.02
Condensing Pressure at 86°F (p.s.i. absolute)	18.3	108.0	174.5
Freezing Point (°F) at 1 Atmosphere Pressure	−168.0	−247.0	−256.0
Critical Temperature (°F)	388.4	232.7	204.8
Critical Pressure (p.s.i. absolute)	635	582	716
*Compressor Discharge Temperature (°F)	113	102	131
Compression Ratio (86°F/5°F)	6.24	4.08	4.06
Liquid Viscosity at 5°F (centipoises)	0.650	0.328	0.286
Liquid Viscosity at 86°F (centipoises)	0.405	0.251	0.229
Vapor Viscosity at 1 atm. and 5°F (centipoises)	0.0096	0.0114	0.0114
Vapor Viscosity at 1 atm. and 86°F (centipoises)	0.0111	0.0127	0.0131
Saturated Liquid Density at 5°F (lbs./cu. ft.)	97.88	90.00	83.34
Saturated Liquid Density at 86°F (lbs./cu. ft.)	91.38	80.63	73.36
Saturated Vapor Density at 5°F (lbs./cu. ft.)	0.0815	0.6735	0.8034
Saturated Vapor Density at 86°F (lbs./cu. ft.)	0.4461	2.569	3.213
Specific Volume of Vapor at 5°F (cu. ft./lb.)	12.27	1.485	1.246
Latent Heat of Vaporization at 5°F (B.t.u./lb.)	84.0	69.5	93.5
Net Refrigeration Effect of Liquid 86°F/5°F (B.t.u./lb.)	67.5	51.1	69.3
Specific Heat of Liquid at 86°F (B.t.u./lb. °F)	0.209	0.243	0.335
Specific Heat of Vapor at Constant Pressure of 1 atm. and 86°F (B.t.u./lb. °F)	0.13	0.14	0.15
Specific Heat Ratio at 86°F at 1 atm. (k = Cp/Cv)	1.14	1.14	1.18
*Coefficient of Performance	5.00	4.69	4.65
*Horsepower/Ton Refrigeration	0.943	1.005	1.016
*Refrigerant Circulated/Ton Refrig. (lbs./min.)	2.96	3.91	2.89
*Liquid Circulated/Ton Refrig. (cu.in./min.)	56.0	83.8	68.1
*Compressor Displacement/Ton Refrig. (c.f.m.)	36.3	5.81	3.60
Thermal Conductivity of Liquid at 86°F (B.t.u./hr./sq.ft./°F/ft.)	0.0609	0.0492	0.0595
Thermal Conductivity of Liquid at 32°F (B.t.u./hr./sq.ft./°F/ft.)	0.0680	0.0559	0.0704
Thermal Conductivity of Vapor at 86°F (B.t.u./hr./sq.ft./°F/ft.)	0.0048	0.0056	0.0068
Thermal Conductivity of Vapor at 32°F (B.t.u./hr./sq.ft./°F/ft.)	0.0045	0.0048	0.0060
Toxicity (Underwriters' Laboratories Group No.)	5	6	5A
Flammability & Explosivity	none	none	none
Relative Dielectric Strength of Vapor (compared with Ethyl Chloride as Unity)	3.00	2.40	1.31
Odor	Ethereal	Ethereal	Ethereal
Type of Compressor in Which Usually Used	Rotary & Centrifugal	Reciprocating & Rotary	Reciprocating
Evaporator Temperature Range	30 to 50°F	0 to 50°F	−130°F to 0°F
Solubility of Water in Liquid Refrigerant at 32°F (gm./100 gm. Refrigerant)	0.0036	0.0026	0.060
Solubility of Water in Liquid Refrigerant at 86°F (gm./100 gm. Refrigerant)	0.013	0.012	0.15
Oil Solubility (Miscibility with Lubricating Oils)	yes	yes	yes**

*Based on 5°F Evaporator Temperature and 86°F Condenser Temperature.
**Separates into two phases at lower temperatures.

FREE! VALUABLE NEW FOLDERS! Write today for important new informative folders, "Genetron" Super-Dry Refrigerants for Air Conditioning and "Genetron" Super-Dry Refrigerants for Refrigeration.

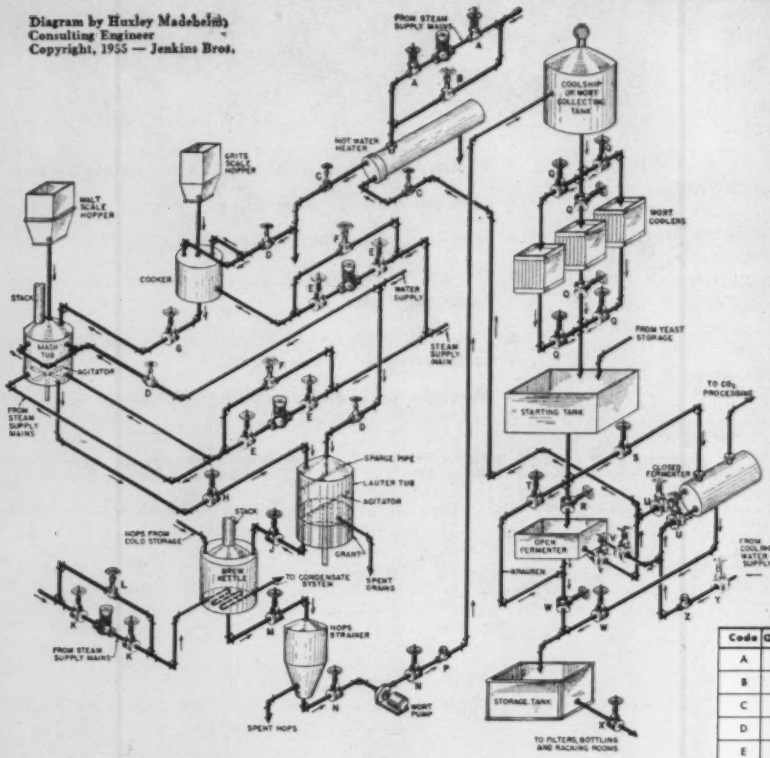
GENERAL CHEMICAL DIVISION
ALLIED CHEMICAL & DYE CORPORATION
40 Rector Street, New York 6, N. Y.

Allied Chemical

Basic Chemicals for American Industry

JENKINS PRACTICAL PIPING LAYOUTS

76



How to plan piping connections for a
GRAVITY-FEED MULTIPLE-STORY BREWERY

This piping layout is typical of installations in many breweries designed for gravity-feed processing, and the principal operations are briefly outlined.

Corn grits are cooked with water in the cooker, with enough added malt to convert and liquefy the grits. When the malt, which has been mixed with water in the mash tub, is properly steeped, the finished cook is dropped into it and the resulting mash thoroughly mixed.

Pumped into the Lauter tub, the mash grains settle to form a filter bed, from the bottom of which the clear liquid containing fermentable and unfermentable sugars is drawn. Extraction is increased by "sparging" with hot-water spray. This liquid, the "wort", flows by gravity to the brew kettle.

In the brew kettle, the wort is boiled with hops to add flavor and to clarify and preserve it. The hops are then strained off, and the liquid is pumped to the "coolship" tank to settle. It then goes through coolers to reclaim most of the residual heat, and on to the starting tank.

In the starting tank, the yeast is added, and the mixture flows to the fermenters, some of which are closed to collect the carbon dioxide gas for future use. After fermentation, the beer is cooled again and sent to storage tanks for eventual bottling and racking.

Consultation with accredited piping engineers and contractors, experienced in brewery design, is recommended when planning any phase of the various processing systems.

To simplify planning, select all the valves you need from the complete Jenkins line. It's your best assurance of *lowest cost in the long run.* Jenkins Bros., 100 Park Ave., New York 17.

Complete description and enlarged diagram of this layout free on request. Includes additional detailed information.

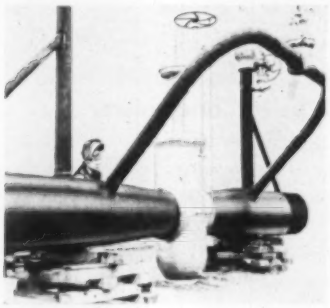
VALVE RECOMMENDATIONS
For details of valves to suit varying conditions see Jenkins Catalog.

Code	Quan.	Jenkins Valve	Service
A	2	Fig. 275 Bronze Gate	Shutoff steam to heater
B	1	Fig. 536-P Bronze Globe	Bypass to heater
C	2	Fig. 47 Bronze Gate	Shutoff water heater
D	3	Fig. 106-A Bronze Globe	Continuous water flow
E	4	Fig. 204 I.B. Gate	Process steam shutoff
F	2	Fig. 576-P Bronze Globe	Bypass water valve
G	1	Fig. 677-A Bronze Gate	Shutoff cooker mash
H	1	Fig. 677-A Bronze Gate	Shutoff finished mash
J	1	Fig. 677-A Bronze Gate	Shutoff wort to kettle
K	2	Fig. 204 I.B. Gate	Shutoff steam to kettle
L	1	Fig. 576-P Bronze Globe	Bypass to kettle
M	1	Fig. 677-A Bronze Gate	Shutoff wort line
N	2	Fig. 677-A Bronze Gate	Pump shutoff
P	1	Fig. 352 Bronze Swing Check	Prevent backflow
Q	6	Fig. 677-A Bronze Gate	Shutoff coolers
R	1	Fig. 677-A Bronze Gate	Shutoff open fermenter
S	1	Fig. 677-A Bronze Gate	Shutoff closed fermenter
T	2	Fig. 677-A Bronze Gate	Krausen line
U	2	Fig. 675-A Bronze Gate	Water to closed fermenter
V	2	Fig. 675-A Bronze Gate	Water to open fermenter
W	2	Fig. 677-A Bronze Gate	Shutoff storage
X	1	Fig. 677-A Bronze Gate	Shutoff rack & bottling
Y	1	Fig. 675-A Bronze Gate	Shutoff well water
Z	1	Fig. 352 Bronze Swing Check	Prevent backflow

JENKINS VALVES
LOOK FOR THE JENKINS DIAMOND
SINCE 1864
SOLD THROUGH PLUMBING-HEATING AND INDUSTRIAL DISTRIBUTORS

EQUIPMENT DEVELOPMENTS...

For reviews of Recent Trade Literature see Page 260



Headers . . .

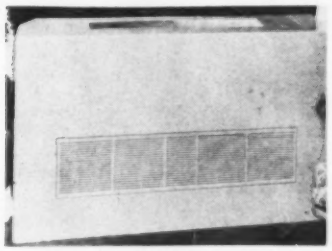
. . . with multiple seamless outlets, factory fabricated conical reducer — Ladish Co., Cudahy, Wis. Designed to simplify installation; reduce cost of bypass, blowdown, branch connections in pipeline gate settings. Provides resistance to stresses from thermal difference, external mechanical loads, shock and vibration loads. Shown are headers being welded into position to pipeline valve, auxiliary service lines.

Power Drive . . .

. . .added to company's line of pipe tools, machines—Toledo Pipe Threading Machine Co., 1445 Summit St., Toledo 4. "No. 78 Vermette" features heavy duty construction, compactness, is lightweight, says company. Unit with folding tripod legs weighs 75 lb. Designed for cutting, reaming, threading, fitting operations. For ¼ to 2 in. pipe, conduit. With variable speed 115 volt, reversible, air cooled, a-c/d-c motor.

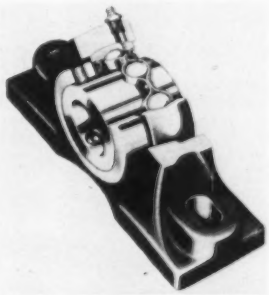
Condensation Return . . .

. . .units with large receiver tanks where greater storage capacity desired—Aurora Pump Div., New York Air Brake Co., Aurora, Ill. For heating systems with ratings 800 to 10,000 EDR, pressures to 30 psi. In simplex (single pump), duplex (twin pump) models. Latter are for two-boiler connections, or to provide standbys for single boilers.



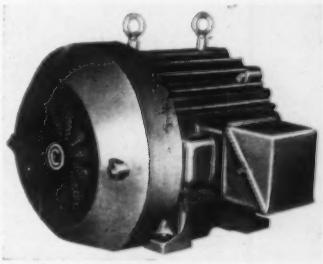
Console Air Unit . . .

. . .designed for year 'round conditioning of individual spaces—York Corp., Roosevelt Ave., York, Pa. Replaces radiator, utilizes conventional steam or hot water heating pipes connected directly into unit. Requires no additional piping, drains. Outside air intake installed flush with outside wall for condenser cooling.



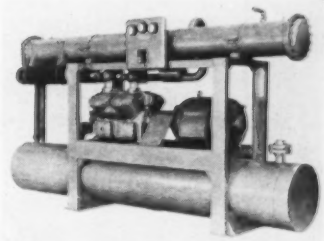
Ball Bearings . . .

. . .for medium duty service conditions—Dodge Mfg. Corp., Mishawaka, Ind. Added to company's line, bearings are said to provide greater load carrying capacity. Are available in larger shaft sizes. Line includes ball bearing pillow blocks, flange cartridge mounts. Lubricant sealed in. Locking pin prevents rotation of outer bearing race while allowing self alignment.



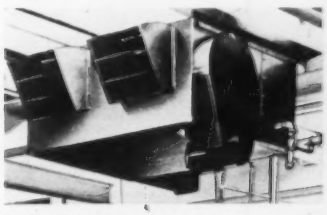
Fan Cooled Motors . . .

. . .in 7½ to 100 hp series—Century Electric Co., 1806 Pine St., St. Louis. Totally enclosed design. Cited features: "Six Layer Insulation" for stator windings, fan provides same cooling efficiency when operated in either direction, rib type cast iron frame construction. Also meets NEMA requirements. Shown is 50 hp model.



Water Cooling Machines . .

. . .with packaged design for air conditioning, process refrigeration installations ranging 5 to 125 hp—Carrier Corp., 300 S. Geddes St., Syracuse 1. In 12 models 25 to 75 hp for chilled water capacities to 100 tons. All components come as single unit.



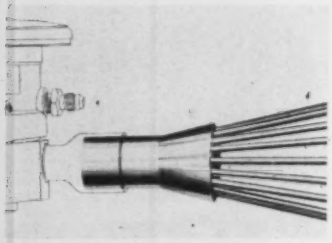
Unit Heaters . . .

. . .with wide capacity, application range—C. A. Dunham Co., 400 W. Madison St., Chicago. Blower type design. In 170 ratings 125,000 to

EQUIPMENT DEVELOPMENTS

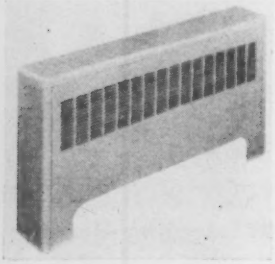
Continued

1,500,000 Btu, 1430 to 20,800 cfm. For floor, wall, ceiling mounting. Can be used with or without ducts.



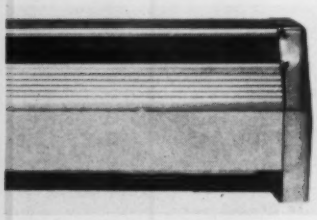
Refrigerant Distributor . . .

. . . designed to solve problems connected with multicircuit evaporators —Alco Valve Co., 865 Kingsland Ave., St. Louis 5. "Venturi-Flo" is said to assure equal flow of refrigerant to all passes of system. Has no nozzles, moving parts. Works equally well in any position, says company. Engineered for range 25 to 150 percent rated capacity.



Convectors . . .

. . . with low resistance steam, hot water headers—Spartan Convector Co., Inc., 19 Clay St., Brooklyn 22. In free standing, wall hung, recessed models. Line features dampers in popular sizes. Widths are 4, 6, 8 in.

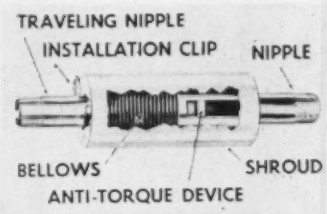


Baseboard Radiation . . .

. . . cover assemblies with chrome finish—Spi-Rol-Fin Corp., 133 Greenwood Ave., Pequannock, N. J. For light commercial, residential use. In standard 3, 4, 5, 8 ft lengths. Also available in specified lengths to 14 ft. For areas where cleaning, appearance is problem.

2 Hp Room Conditioner . . .

. . . for use in rooms 1000 to 1300 sq ft—Mitchell Mfg. Co., 2525 N. Clybourn Ave., Chicago. Added to company's line of ¾, 1, 1½ hp units. Models are of same cabinet size.

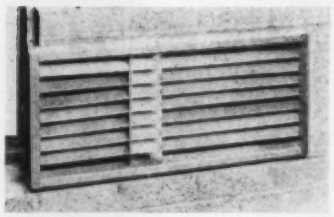


Expansion Compensator . .

. . . for vertical heat riser lines—Flexonics Corp., Maywood, Ill. Has two ply stainless steel bellows as pressure carrier. Is enclosed in steel housing with steel pipe nipples on both ends. Has antitorque device to protect bellows during installation. In NPT sizes ¾ to 3 in. Will take pressures to 150 psi, absorb line expansion of 1½ in.

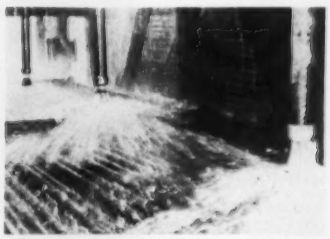
Coal Tar Tape . . .

. . . for pipe, joints, fittings, couplings —Tapecoat Co., 1523 Lyons St., Evanston, Ill. Requires only single wrap with ½ in. overlap. Cited advantages: increased coverage due to single wrap feature, easy application through special separator film, time and labor savings. In rolls 2, 3, 4, 6 in. wide.



Built-In Conditioner . . .

. . . for new apartment buildings—Amic Mfg. Corp., 21-25 44th Ave., Long Island City 1, N. Y. Self contained, is designed to be silent, virtually service free, weatherproof, long lasting. Uses high humidity overflow design for condensation disposal. One hp unit has 11,000 Btu output, 50 percent outdoor air intake. Shown is exterior view of unit installed.



Spray Head . . .

. . . designed for even spray distribution of low pressure fluids from discharge pipes—N. C. Stearns Co., P. O. Box 1234, Shreveport, La. For controlled spray at pressures under 5 psi. Recommended by company for cooling towers, vertical coils. Metal parts are polished stainless steel.

Heavy Duty Wrench . . .

. . . with new spring design—Erie Tool Works, 735 W. 12th St., Erie, Pa. Spring is "Z" shaped and notched to fit under pin running transversely through wrench housing, pin acting as pivot. Designed to give positive double action, make bite and release more rapidly, improve ratcheting. In 6 to 48 in. sizes with straight handles, 8 to 18 in. in offset type.

The total heat the summer sun pours down on a 1,000 sq. ft. roof of a house at noon on a clear day may run as high as 250,000 Btu's per hour. Some white shingles have been credited with the ability to reflect, OUTDOORS, about 55% of the sun's rays, yellow 35%, green 15%, red 14%, blue 5%, black 4%.

White shingles won't always stay white, don't always harmonize with the desired color-scheme, easily look soiled. So despite the greater efficiency of white (which is true only OUTDOORS), roofs may nevertheless be ANY color to harmonize with the building, its environment, and the tastes of its occupants, and still be considerably cooler inside than out; IF--- six (or even four) reflective spaces and reflective surfaces are installed beneath the roof.

The comfort and efficiency of this scientific combination, produced by 3 sheets of aluminum and 2 of fiber, air-spaced apart, is remarkable because of its effectiveness in repelling radiation which is responsible for about 93% of all *heat in-flow* down from the roof to the living quarters. The surfaces of the aluminum sheets reflect radiation with a 97% rate, and absorb and emit radiation at a rate of only 3%.

Since there is NO convection in down heat flow, and slight conduction thru the multiple, low density air spaces, a triple barrier to *heat in-flow* is raised.

In winter, too, this form of insulation is effective, because 55% to 70% of heat flow upwards through air space is by radiation. Convection, ranging to 45%, is retarded by the 3 aluminum sheets and also by the 2 fiber separators. In up heat flow, conduction is also slight because of air's low density.

The best shingles or most beautiful paint job on the exterior or interior, will not protect against peeling paint, timber rot, and crumbling plaster caused by destructive condensation..... The 6-reflective-space-aluminum-surface combination is almost completely impervious to water vapor and by its scientific construction minimizes condensation formation on or within it.

It is available in pre-fabricated form, ready to install, and is called Infra Insulation Type 6. **More than 250 million sq. ft. of INFRA has been installed in the past 10 years.**

How house-cooling systems can be made to cost less for installation and for operation by scientifically insulating buildings, is made graphically clear in an illustrated brochure *"Five top priorities for designing an air-conditioned house,"* a reprint of an article which originally appeared in "House & Home." We will send it free at our expense if you mail the coupon.

COST OF EDGE-TO-EDGE INFRA
Multiple Aluminum Insulation installed in new construction between wood joists, material and labor
Type 6-PS about 10¢ sq. ft.
Type 4-PS about 8¢ sq. ft.

Infra Insulation, Inc., 525 B'way., New York, N. Y.
Dept. H-9

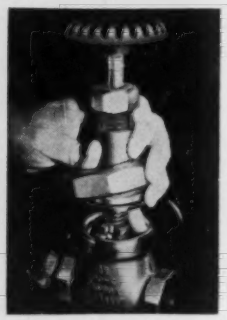
Please send: "Five Top Priorities"

Name_____

Firm_____

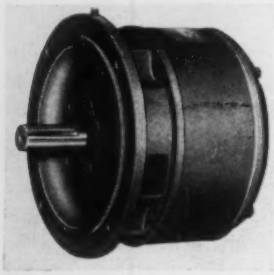
Address_____

EQUIPMENT DEVELOPMENTS
Continued



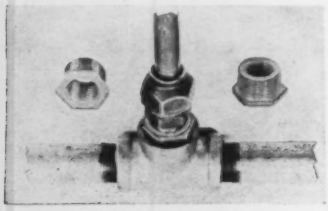
Gate Valve . . .

. . .with renewable seat ring—Fairbanks Co., 393 Lafayette St., New York 3. Permits replacement while valve remains in the line. Done by disassembling bonnet, unscrewing, lifting out seat rings from body. Process requires only 7 to 10 min, says company. Valve in ½, ¾, 1, 1¼, 1½, 2 in. sizes. For pressure 200 psi steam, 400 psi water, oil, gas.



Motors . . .

. . .with shorter round frame, flange mounted construction—Century Electric Co., 1806 Pine St., St. Louis. In models 1 to 15 hp, line will replace old design in that range. Are lighter weight, designed for space economy. With NEMA flange dimensions. Furnished in open type frame or totally enclosed fan cooled type.

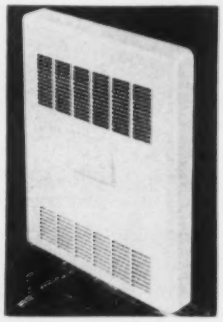


Dielectric Bushing . . .

. . .for control of electrolysis in piping, heating, gas applications—May Co., Galesburg, Ill. Made from nylon to withstand temperatures 300 F, says company. Encased in metal to support against stress.

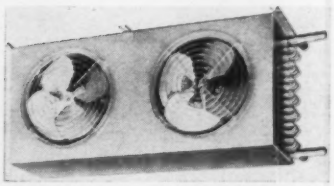
Welding Ring . . .

. . . with flat type design, ⅛ in. diameter spacer pins — Tube Turns, Louisville. Designed to improve submerged arc welding of pipe, fittings. Also suitable for manual welding applications. Spacer pins are said to automatically center ring in joint, prevent ring from shifting.



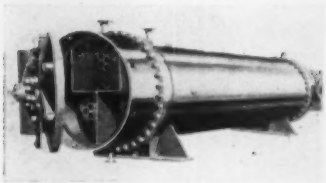
Heating-Cooling Unit . . .

. . .for recessed, semi-recessed, free standing cabinet installation—Warren Webster & Co., Camden 1, N. J. Cabinet measures 14 in. wide, 20 in. high, 6¾ in. deep. Fits within standard stud spacing of 16 in. centers. Consists of flow coil, filter, three speed fan, drip connection. Rubber mounted motor, fan.



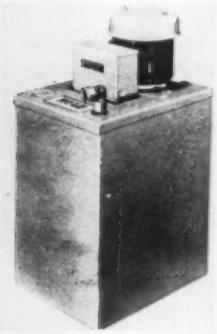
Air Cooled Condensers . . .

. . .for single, multiple compressor installation, indoor or outdoor—A.H. Witt Co., 940 N. Sycamore Ave., Los Angeles 38. Require no water. Recommended by company for installations where water supply limited, drainage facilities inadequate, local laws limit use of water for condensing. Nominal tonnage based on 90 F ambient, 115 F condensing temperature. For different temperatures, correction factors apply.



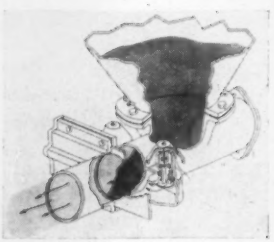
Quick Opening Door . . .

. . . for heat exchangers, autoclaves, sterilizers, other pressure vessels — Patterson-Kelley Co., Inc., 10 Lackawanna Ave., East Stroudsburg, Pa. Takes about 5 sec to open "Lever-Lock" door, says company. Designed to withstand temperatures —70 to 400 F, pressures from vacuum to 300 psi. Bars on door inserted into, withdrawn from fittings in vessel by hand operated lever.



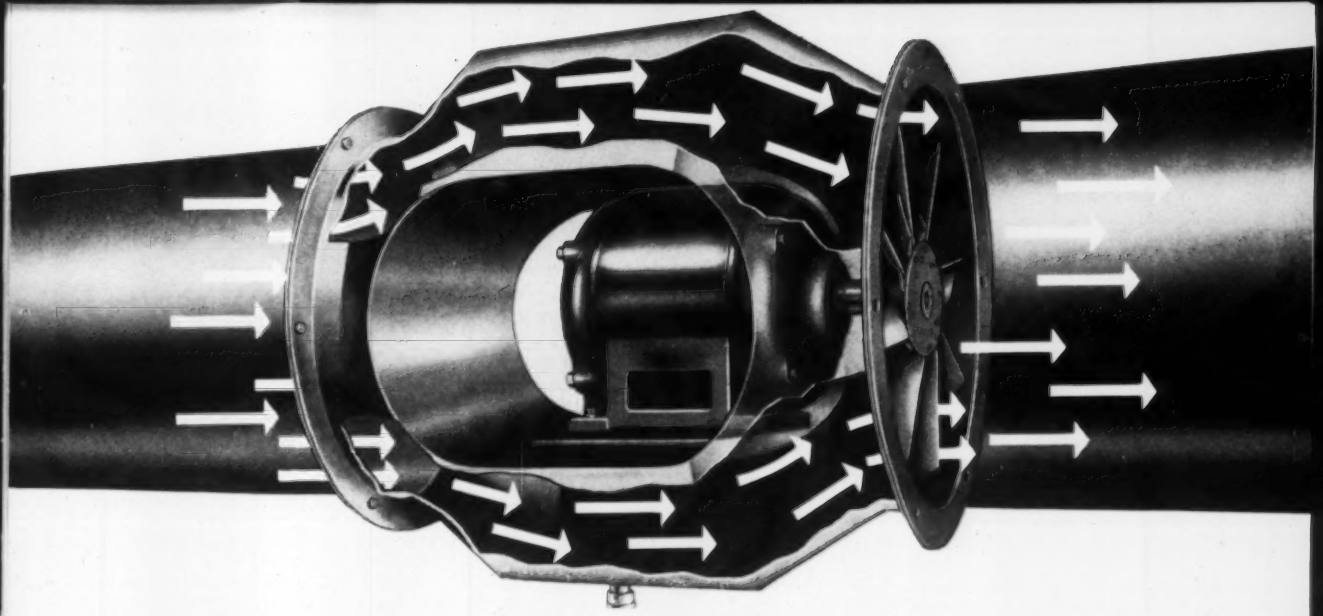
Disposal Unit . . .

. . .for condensate water accumulated from central air conditioning systems —Hy-Lo Burner Co., Eddington, Pa. Consists of reservoir tank, motor-pump combination, float switch mechanism. Switch serves as junction box for wiring, allows use of conduit where required. Tank dimensions are 6 × 8 × 9½ in. deep. Motor extends 4 in. above.



Valves . . .

. . .for materials handling—Allen-Sherman Hoff Co., 259 E. Lancaster Ave., Wynnewood, Pa. Designed for efficient flow control in pneumatic



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EXHAUSTING FUMES THE *DIRECT WAY*

and contains "fan information" section

Reserve your copy of this new Bifurcator® Fan catalog now being printed. The catalog goes into detail on the *direct* way in which the Bifurcator Fan exhausts fumes . . . and also includes the latest improvements made in the Bifurcator Fan itself. This catalog is packed with up-to-date information on Bifurcator sizes and capacities, dimensions, volume and pressure fan wheels, protection against corrosion, and certified capacity ratings.

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- velocity pressure table
- friction chart
- loudness level table

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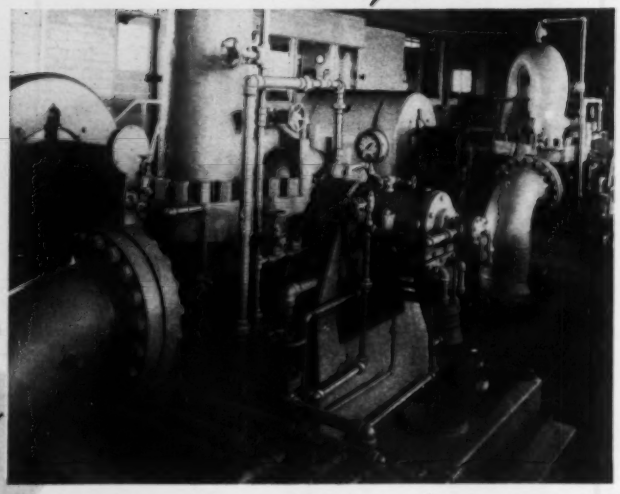

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■ In high pressure steam lines...process liquid and gas piping...hydraulic fluid lines...wherever strong, tough pipe joints are needed, Watson Stillman Forged Steel Fittings provide a safety factor against costly piping failures. They resist pressure, heat, corrosion, shock and vibration because they're drop-forged of high quality steel to produce a dense, tough, forged-fiber structure that can really take it.

Extra strength is built into W-S fittings in other ways too...such as the heavy reinforcing bands extending well beyond the threads or sockets.

Protect your high pressure piping system with Watson-Stillman Forged Steel Fittings. Available in carbon, stainless and alloy steels, in Screw-End and Socket-Welding Types to meet your service requirements. Send today for Free Catalogs.

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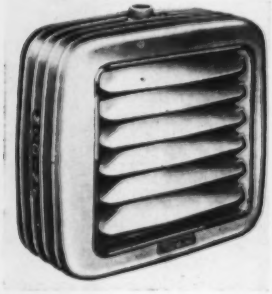
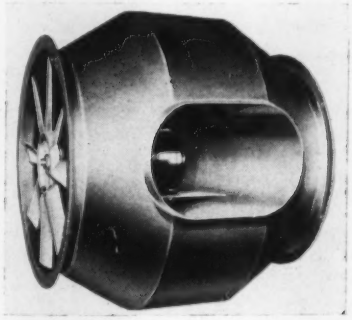
EQUIPMENT DEVELOPMENTS
Continued

transport of fine solids. Cited features: nonplugging operation with positive shutoff, maximum carrying capacity, minimum frictional wear, ease of maintenance. For installation in vacuum transport piping systems. Available with air-electric, remote or manual controls.



Unit Heaters . . .

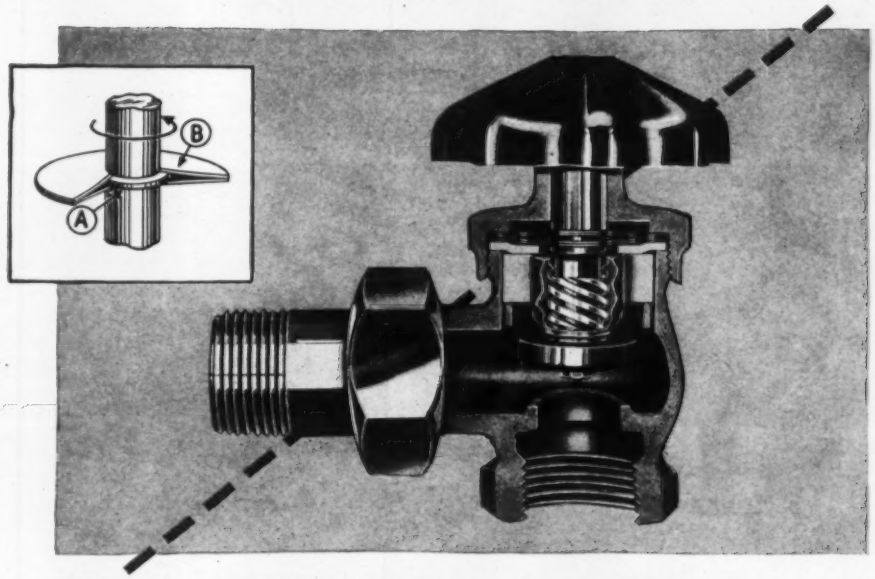
. . . for applications where internal corrosion problems severe — Modine Mfg. Co., Racine, Wis. Use special alloys for condenser tubes. Condensers, casings coated, baked with protective finish. In 12 horizontal delivery units ranging 43,000 to 280,800 Btu per hr, 16 vertical delivery units with capacities 140,000 to 609,600, and 10 horizontal delivery draw-through type units with 195,700 to 609,600 capacities.



Duct Fan . . .

. . . for high temperature applications —Hartzell Propeller Fan Co., Piqua, Ohio. Recommended for ovens, oil and gas fired induced draft boilers, moving corrosive fumes. In two classes with standard or heavy duty construction. In 25, 29, 37 in. diameters.

A Valve that is



PACKLESS in fact

. . . not just packless in name

When the job calls for the kind of valve that will stand up across the years —when it calls for a valve that is packless in the full meaning of the word— then, no matter how far you look, you'll find in the Marsh Packless the only valve that completely fills the bill.

In fact, many users consider this the only valve that is packless in fact as well as in name, and they have a good reason for this. There is a difference between pack less and packless! The diagram tells the story of Marsh truly packless construction. A collar (A) is machined on the valve stem. The stainless spring steel wafers (B) press against this collar to form a tight annular seal This, you see, is a metal-to-metal seal—*permanently* leakproof.

And this better construction is typical of the quality and refinement found throughout the Marsh Packless Valve—in the swivel, self-seating, self-cleaning disc—in the excellent proportioning, machining, workmanship and finish.

Packed valves can and do "blow out", scalding or burning the operator. This danger is avoided when you use the Marsh Packless. It is a valve you can rely on for any service up to 100 lbs. Furnished in a wide range of patterns including graduated and extended stem types, the Marsh Packless Valve is widely used for steam and hot water heating systems, coffee urns, steam kettles, sterilizers, ovens and similar services. Ask our representative or engineering department for facts.

MARSH HEATING EQUIPMENT CO. *Sales affiliate of Jas. P. Marsh Corporation*

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Marsh Instrument & Valve Co. (Canada) Ltd., 8407 103rd Street, Edmonton, Alberta, Canada

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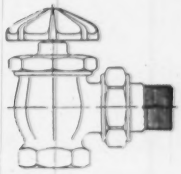
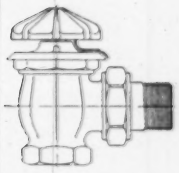
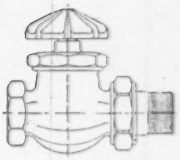


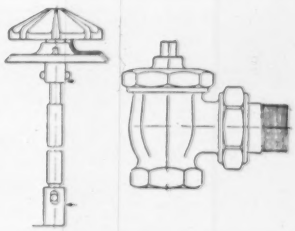
Wheel Angle



Wheel Angle Graduated



Globe



Extension stem

- FOR HEATING
- PROCESSING
- AIR CONDITIONING

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STEAM AND HOT WATER GENERATORS

18 ____ 500 hp.
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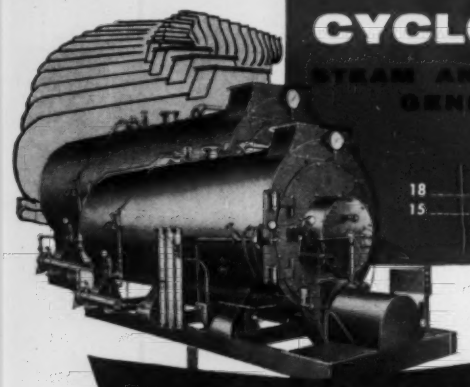

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Satisfied users say "Cyclotherm Steam and Hot Water Generators will meet your requirements under the most exacting steam demands and rugged operating conditions . . . in a variety of climates and elevations.

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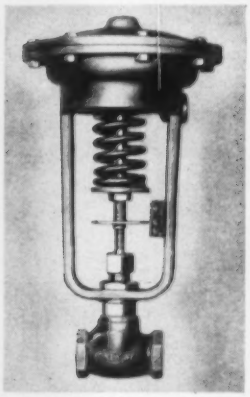
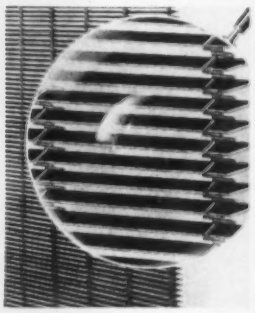
EQUIPMENT DEVELOPMENTS

Continued



Control Valves . . .

. . . for medium duty applications—Minneapolis-Honeywell Regulator Co., Valve Div., Philadelphia. Diaphragm type. Line includes double seated, single seated, three-way types for use in *on-off* or proportional control systems. Component parts in series are standardized to reduce spare part requirements.



Solar Screening . . .

. . . designed for greater corrosion-resistance—Reflectal Corp., 310 S. Michigan Ave., Chicago 4. "Kool-Shade Type RS" has plastic coating electrostatically sprayed to bonderized steel louvers. Consists of small horizontal louvers set at angle to screen out solar heat, glare. Shown is "magnified" view of construction.

Thermostat . . .

. . . designed on building block principle—Fenwal, Inc., Ashland, Mass. Can be tailored to individual applications, says company. For temperature control, overheat detection at electrical loads to 20 amp. Available in combinations of head styles,

SILENT partner of the air conditioning industry

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You can build added sales power today and count on repeat sales tomorrow when your products feature SEALMASTER Ball Bearing Units. **Quiet,** efficient "round the clock" performance is assured with SEALMASTER Bearings and their exclusive combination of features.

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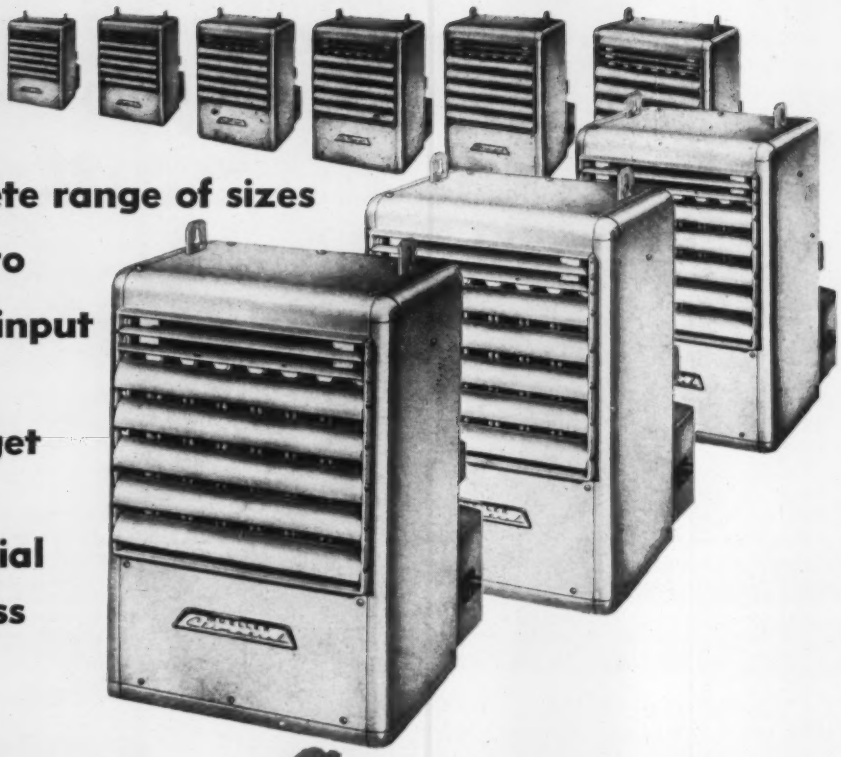

Now — a complete range of sizes from 25,000 to 225,000 BTU input

...to help you get a bigger share of the commercial heating business

Mueller Climatrol

Type 160 Gas, Direct-fired Unit Heaters

Here's the perfect answer to your space heating problems — Mueller Climatrol Type 160 gas, *direct-fired*, suspended unit heaters. They're compact, attractive, efficient — easy to install and service.

The Type 160 is A.G.A. approved for use with natural, mixed, manufactured, and propane gas. Check these "advance design" features built in this unit.

Compact — only 29½" x 19½" x 12" (for the 50,000 Btu size.)

Easy to Install — shipped pre-wired and pre-assembled. Easy to hang.

High Crown Sheet — no "hot spots," no joints or welds exposed to flame.

Welded-Steel, Air-Tube-Type Heat Exchanger — for maximum heat extraction, efficiency, *longer life*.

Quiet Fan — propeller type, properly pitched for even air distribution.

Cast-Iron, Drilled-Port Burner provides even heat distribution over entire hearth area.

Built-In Diverter with rear flue outlet.

Adjustable louvers let you direct the air where you want it.

Smooth Finish in Mountain Spring Green color, easy to repaint to match room decor.

Write for facts and figures that tell you more about this Mueller Climatrol unit heater line.

Mueller Climatrol

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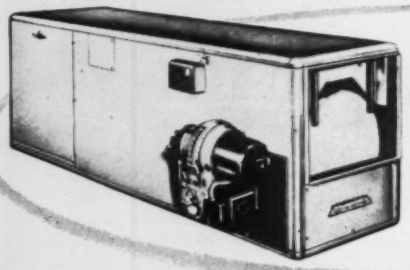


Also the Type 253 Oil-fired Unit Heater

This modern oil-fired unit is available in four sizes — 110,000, 150,000, 200,000 and 250,000 Btu input. It can be suspended as a unit heater or it can be used as a horizontal furnace in homes for perimeter, radiant warm-air and conventional, forced, warm-air heating. Equipped with a large, quiet blower, the Type 253 is shipped assembled and pre-wired.

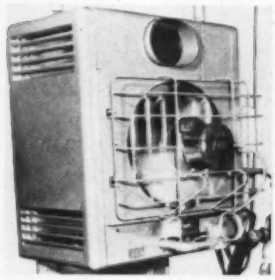
98th Anniversary MUELLER • MILWAUKEE

D-179

EQUIPMENT DEVELOPMENTS

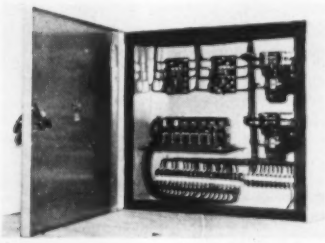
Continued

mounting arrangements for use in gases, solids, liquids. Selection based on building block feature: temperature range, type of switch, type of enclosure for switch, type of mounting arrangement.



Gas Fired Unit Heaters . . .

. . . with split capacitor motors—Janitrol Heating & Air Conditioning Div. of Surface Combustion Corp., Columbus, Ohio. Offered on all units with 175,000, 200,000, 225,000 Btu capacity. Manufacturer expects greater dependability of operation, lower maintenance cost with new motors.

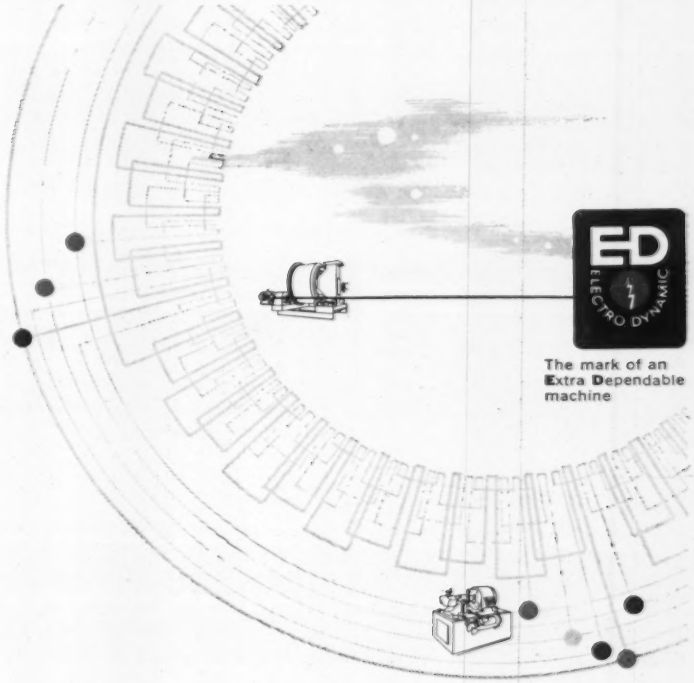


Control System . . .

. . . for dual tank "Zeolite" softeners—Graver Water Conditioning Co., 216 W. 14th St., New York. System is part of preengineered softening unit including electrical control panel, flow meter, multiport valve, softeners, brine measuring tanks, connecting lines. System features electrical control panel of series of relays, multiple cam timer to initiate periodic, timed regeneration of softeners.

Large Diameter Hose . . .

. . . with integral couplings for conveying liquids in large quantities—Thermoid Co., Trenton, N.J. For pressures 1500 to 2500 psi where



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a better kind of power

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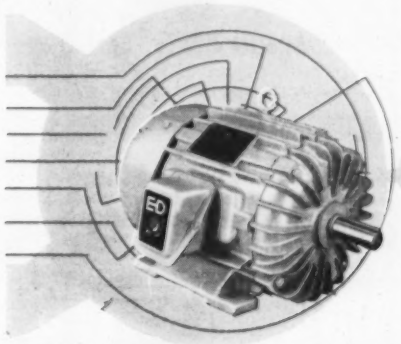
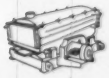


1 to 250 hp. AC and DC. N.E.M.A. standards.

Extra starting and anti-stalling capacity: Extra cool, extra quiet operation: Achieved without sacrifice of full-load efficiency. Backed by unparalleled experience, E.D. motors are *extra dependable*—75 years in the making—yours today *at no extra cost!*



ELECTRO Extra DYNAMIC Dependable motors

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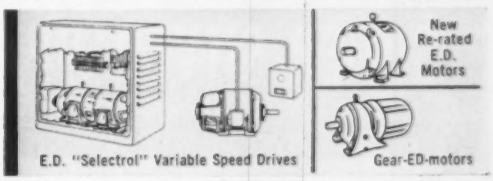
PRODUCT OF GENERAL DYNAMICS

NEW...

Write for Brochure 100 and literature on new E.D. motors and drives.

Electro Dynamic division of General Dynamics Corporation Bayonne, New Jersey



IT'S FLATTERING TO BE IMITATED

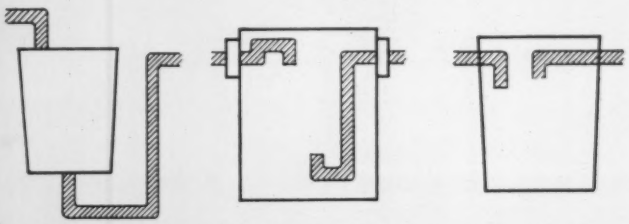
● Old Davy would be mighty flattered if he were here to see his imitators. We, too, at Anderson are flattered that so many trap manufacturers have imitated Super-Silvertop's straight-through piping. Such action acknowledges Super-Silvertop's leadership.

Years ago we discovered if properly designed a steam trap could be installed as an elbow or straight-in-line saving 9 pipe fittings and a half-hour's labor. Although many other traps are now using the straight-through design, there is still a basic important difference. They only offer the straight-through design and not optional design of either straight-through or elbow inlet connection. Also their design is available in only a few sizes and is obtained by means of building piping into the trap, instead of a truly engineered design. Built-in piping results in narrow, thin-walled, hard to clean, cored passages that can cause gaskets to blow.

The next time you buy or specify, select Super-Silvertops with straight-through and elbow installation . . . in all sizes.

THE V. D. ANDERSON CO.
1949 West 96th Street
Cleveland 2, Ohio

Only SUPER-SILVERTOPS offer Simplified Piping Without the Use of Narrow Thin-Walled Passages



This conventional design requires 9 fittings and complicated piping.

This design eliminates the fittings but results in narrow cored passages.

Only Super-Silvertop eliminates narrow-cored, thin-walled, passages.

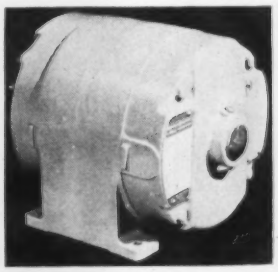
SUPER-SILVERTOP Steam Traps

Quality Steam Traps Since 1886

EQUIPMENT DEVELOPMENTS

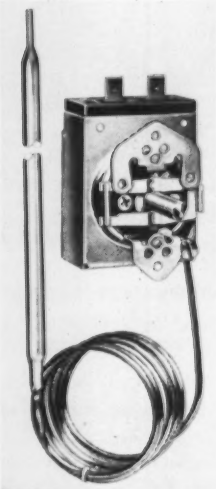
Continued

flexibility required. Hose connected to couplings by steel cables drawn through slots milled into solid steel tube and secured by set screws. Designed to eliminate sudden parting of hose, couplings. Sizes to 6 in. ID.



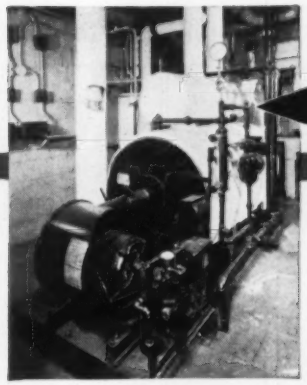
Air-Over Motor . . .

. . . designed to produce varying horsepower with application of varying air velocities — General Electric Co., Schenectady 5, N.Y. Totally enclosed. Lighter, smaller than previous models. Nonventilated, motor is cooled by air flow over it caused by fan or blower it powers.



Electric Thermostat . . .

. . . for electric room heaters, unit air conditioners, commercial appliances — Robertshaw Thermostat Div., Robertshaw-Fulton Controls Co., Youngwood, Pa. Available in direct acting, reverse acting types. Longest dimension is less than 3 in. Optional dials available in standard temperature ranges.



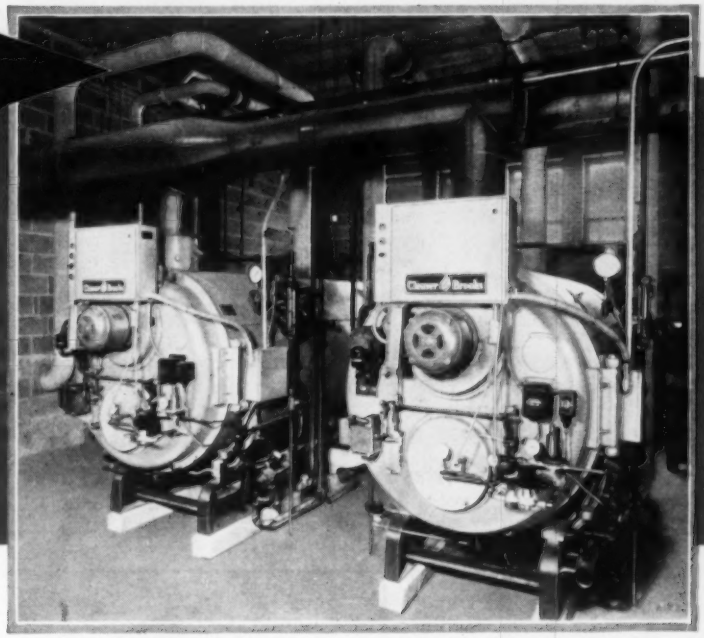
1931

Cleaver-Brooks pioneers big steam capacity in small space

This veteran 20-hp heating boiler — built by Cleaver-Brooks and installed in 1931 — is still in daily use. It is proof of the dependable service you can expect from Cleaver-Brooks' famed four-pass, self-contained boiler construction for any heating or processing need.

1955

Cleaver-Brooks is first again with the ALL NEW "CB" boiler



- All main burner components are completely integrated for automatic operation.
- More boiler capacity in less space through elimination of extended burner assembly platform.
- Guaranteed 80% efficiency — Four pass construction. 5 sq. ft. of heating surface per bhp.
- 11 sizes — 79 models — 15 to 150 hp, (steam or hot water) for oil, gas or combination oil/gas use. Other models available through 600 hp.
- Complete (Boiler-Burner) unit approval by Underwriters Laboratories — conforms to ASME codes. Factory tested before shipment.

The "CB" is the most easily maintained package boiler on the market. Removal of only nine bolts (on the largest sizes) opens hinged doors for fast inspection, cleaning or service. This convenience has earned widespread praise of insurance firms.

BOILER users will quickly appreciate the surprisingly silent operation of the new forced-draft "CB" — *with the fan mounted inside the front hinged door.* Design avoids use of thin sheet metal housings and usual "chattering" and vibration.

Even greater combustion efficiency is yours with the new "CB" air-atomizing burner, with integral air compressor. All burner components are confined to the front head and the control panel is at operator eye level.

For complete facts on the boiler that's ahead in design, performance and economy, write: Cleaver-Brooks Company, Dept. K, 313 E, Keefe Ave., Milwaukee 12, Wis., U.S.A. Cable Address: CLEBRO — Milwaukee — All Codes.

Write for copy of latest "CB" Boiler Bulletin covering your size requirements — contains specification data to help you plan.

Cleaver Brooks

Originators of the self-contained boiler

Why you should be selling RAY Burners

Any Ray dealer can tell you Ray burners mean more sales — greater profits. The reason: a superior product, competitively priced! But there's more...

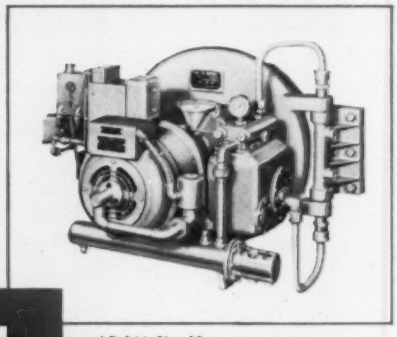
This year, *for the 40th consecutive year, Ray is first in sales! Since 1872, the Ray Oil Burner Co. has pioneered every major improvement* in heavy fuel oil burning: **the horizontal rotary principle; the dual pump and reservoir; the angular vane nozzle; the Ray viscosity valve.** These "firsts" help Ray dealers make more sales by: 1) contributing to the unexcelled performance of Ray burners; and 2) selling customers on the skill and reputation of the company behind these burners.

During this time Ray has also pioneered in major developments of commercial and industrial gas firing equipment and combination gas-oil units.

RAY helps dealers sell service — Besides giving its dealers the best available line of burners, priced to sell, Ray also helps build dealer service volume with a hard-hitting advertising campaign calling attention to the Ray service network.

Complete line builds sales and profits — Ray provides a burner for every purpose, from 1 to 1000 hp., firing light or heavy oil, gas or combination gas-oil; fully-automatic, semi-automatic, or manual control.

To build more sales and greater profits . . . choose Ray, the burner that has led the entire industry in sales for almost half a century! For complete details on how you can become a money-making Ray dealer, write, wire, or phone, Ray Oil Burner Co., San Francisco, Calif.



AR-144, Size 10

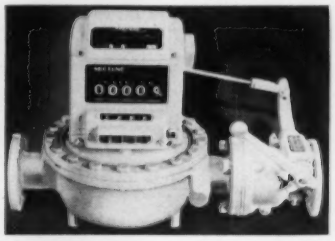
RAY
Since 1872
OIL BURNER CO.

1301 San Jose Avenue
San Francisco 12, California
Atlantic Seaboard Division
629 Grove Street, Jersey City 2, N. J.

The "Why" of Ray's unchallenged leadership in the oil burner industry is explained in the story "FORTY YEARS OF RAY OIL BURNERS." Ask for a copy.

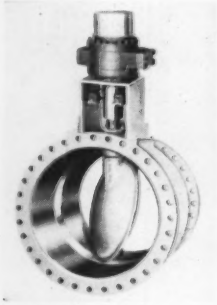
EQUIPMENT DEVELOPMENTS

Continued



Meters . . .

. . . with double trip valves for controlling industrial liquids—Neptune Meter Co., 19 W. 50th St., New York. Designed for accurate cutoff, minimum hydraulic hammer even handling high flow rates. Shuts off when predetermined quantity delivered. In sizes 1½ (10 to 100 gpm flow rates), 2 in. (16 to 160 gpm flow rates). Furnished with double trip or cushioned stop mechanism for low viscosity liquids.

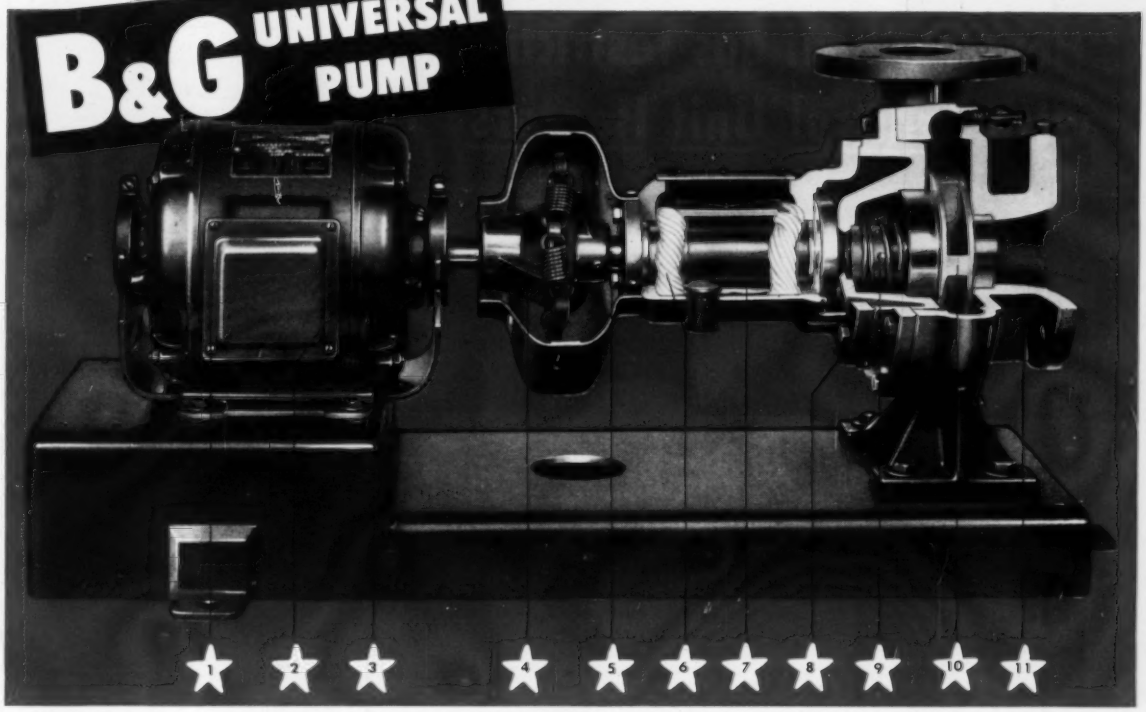


Butterfly Valve . . .

. . . with stress sealed design—W.S. Rockwell Co., 200 Eliot St., Fairfield, Conn. Meets tolerance of permissible leakage in closed position under combination of high pressure, high temperature, says company. Is 36 in. pipe size. For temperatures to 800 F. Operated by hydrometer driven by oil at 300 psi.

Steam Trap . . .

. . . for pressures to 400 psi, temperatures to 500 F — Clark Mfg. Co., 1830 E. 38th St., Cleveland 14. Cast steel constructed, inverted bucket type. Designed to remove condensate from higher pressure steam lines. With ½ or ¾ in. vertical connections.



DESIGNED SPECIFICALLY FOR *QUIET* OPERATION

IN LIQUID HEATING AND COOLING SYSTEMS

No vibration eliminators or flexible connections needed

The circulating pump in a hot water heating or chilled water cooling system is the connecting link between the mechanical equipment in the boiler room and the structure itself. *Silent, vibration-less* operation is therefore the prime requirement in a pump for this type of service. The features starred above are the reasons why the B&G Universal Pump fully meets this need.

THE MOTOR

1. **Extra quiet.** The Universal Pump motor is specially constructed, tested and hand-picked for extra-quiet operation.
2. **Sleeve bearings.** Motors are equipped with oil lubricated bronze sleeve bearings—essential to silent operation and long life.
3. **Mounting.** Universal motors, through 5 HP, are NEMA ring-type mounted and completely suspended in noise-dampening rubber. All motors are drip-proof.

THE PUMP

4. **Coupler.** Self-aligning, spring-type . . . another warranty of silent operation plus excellent pump and motor protection against the stresses of starting torque.
5. **Shaft.** Big—oversized—affording large bearing surfaces. Made of special alloy steel, polished to mirror finish. Heat-treated integral thrust collar absorbs end-thrust . . . lengthens seal and motor bearing life.
6. **Lubrication.** Genuine oil circulating. No grease to channel or harden. Oil level indicator permits visual check.
7. **Sleeve bearings.** An essential for quiet, vibrationless operation and long life of both pump and motor. An outstanding Universal feature.
8. **Removable bearing frame for easy servicing.** The entire bearing frame assembly with impeller is easily removed from volute. No pipe connections to break or motor to remove . . . all the advantages of split case design. All bearing frame assemblies are interchangeable.
9. **Mechanical seal.** Positively prevents water leakage up to full design pressures. The seal is self-lubricating and features a floating seat of diamond-hard "Remite"—a B&G development.
10. **Hydraulically balanced impeller.** Balancing chamber and thrust pressure relief holes in the impeller reduce thrust to a minimum.
11. **Solid volute.** Support feet directly below volute absorb piping strains without distorting pump alignment.

Write for capacity data

BELL & GOSSETT

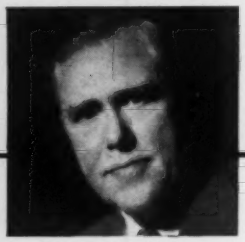
COMPANY

Dept. EA-5, Morton Grove, Ill.

Canadian Licensee: S. A. Armstrong Ltd., 1400 O'Connor Drive, West Toronto

"How we beat gas restrictions with Janitrol Unit Heaters"

AT Huttig SASH & DOOR CO.



"Our Janitrol equipment gives us efficient gas heat, regardless of location."

SAYS...

Mr. F. W. Stewart
Vice President-Treasurer

"Every post-war plant—in Dallas, Charlotte, and St. Louis—is heated by gas-fired Janitrol unit heaters. They were recommended by our engineers. Our Janitrols have operated economically and efficiently," reports Mr. Stewart.

"Also, in areas with gas restrictions, we've found that Janitrol units operate with equal efficiency on our supply of stand-by LP-gas when natural gas is temporarily curtailed."

Change-over is made at a moment's notice by the operation of only two levers. This all-gas system saves considerably over other dual fuel types both in operation and original cost. Where natural gas is not available, straight L-P or "tank" gas is often very practicable.

Photographs show Huttig's new St. Louis plant, one of several with office and production areas heated by gas-fired Janitrol Unit Heaters.

Janitrol
GAS-FIRED UNIT HEATERS

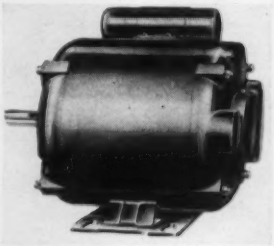
For more information on the use of unit heaters in many types of new or remodeled buildings, write for your copy of "Businessman's Blue Book of Better Heating".

Janitrol Heating & Air Conditioning Division
Surface Combustion Corporation, Columbus 16, Ohio
In Canada: Alvar Simpson Ltd., Toronto 13

ALSO MAKERS OF Surface INDUSTRIAL FURNACES AND Kathabar HUMIDITY CONDITIONING

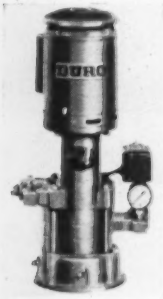
EQUIPMENT DEVELOPMENTS

Continued



Motors . . .

. . . with ball bearings, dual voltage windings — Acec Electric Corp., 40 E. 49th St., New York 17. Single phase, fractional horsepower. For air conditioning, refrigeration machines, fans, pumps, blowers, compressors, conveyors, oil burners. In ¼, ½, ¾ hp, 1200, 1800, 3600 rpm ratings, for 115 or 230 volts, 60 cycles.



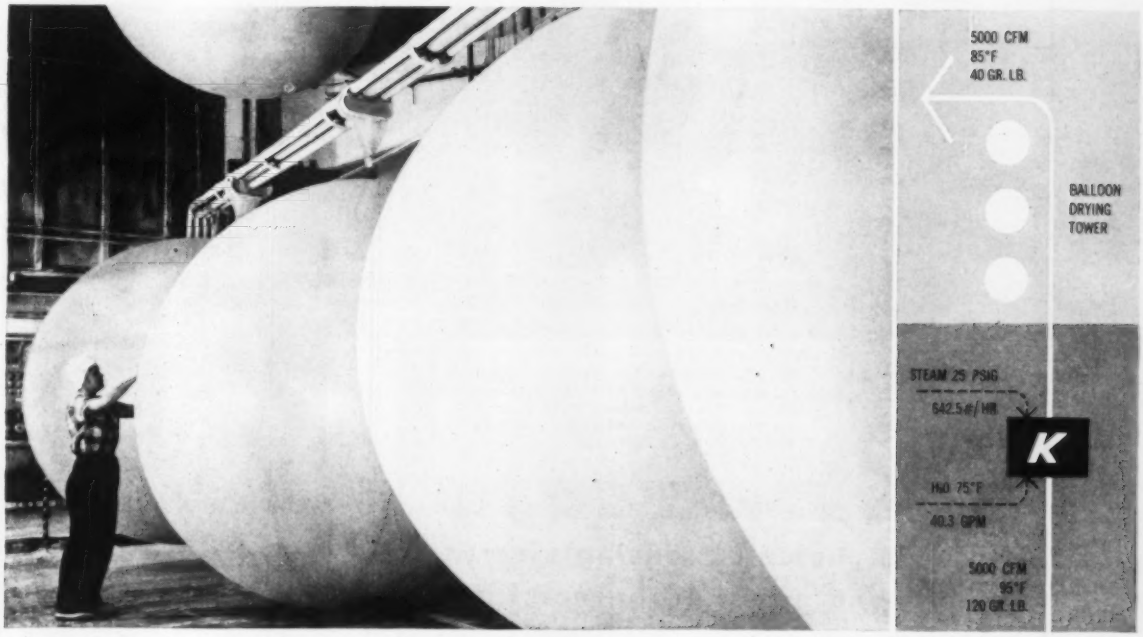
Multistage Pumps . . .

. . . in sizes ½ to 5 hp—Duro Co., 537 E. Monument Ave., Dayton, Ohio. Designed to deliver large water volume from wells to depths over 300 ft. With "Elect-O-Stage" feature, user chooses number of impeller stages for his requirements. Has capacitor type 60 cycle motor, stainless pump shaft, bronze stuffing box and impellers.

Welding Cable . . .

. . . of lightweight aluminum—Tweco Products Co., P. O. Box 666, Wichita 1. Has flexibility which makes welding easier, less tiresome, says company. In grade "SR" with synthetic rubber jacket for normal use, "N-60" with neoprene jacket reinforced with rayon braid for where oil, heat, chemicals, abrasion, rough usage encountered. Available on packaged coils, reels.

Dry air saves balloon-maker $2500/yr.



Low-temperature dry air saves the Dewey and Almy Chemical Company $2500 or more a year in operating costs. Kathabar humidity conditioning delivers this air for drying weather balloons (see flow diagram) using only 75°F city water and low pressure steam. Dewpoint of the air is reduced from 72.5°F to 43°F without refrigeration!

Compared with standard refrigeration for the same operation, the Kathabar system saves 81¢ an hour in water, steam, and electricity requirements—operating savings of over $6 per 8-hour day! In addition, the first cost of Kathabar equipment is lower, operation and maintenance are simpler.

If your operations require low-temperature drying, it will pay you to investigate the many economies of Kathabar humidity conditioning.

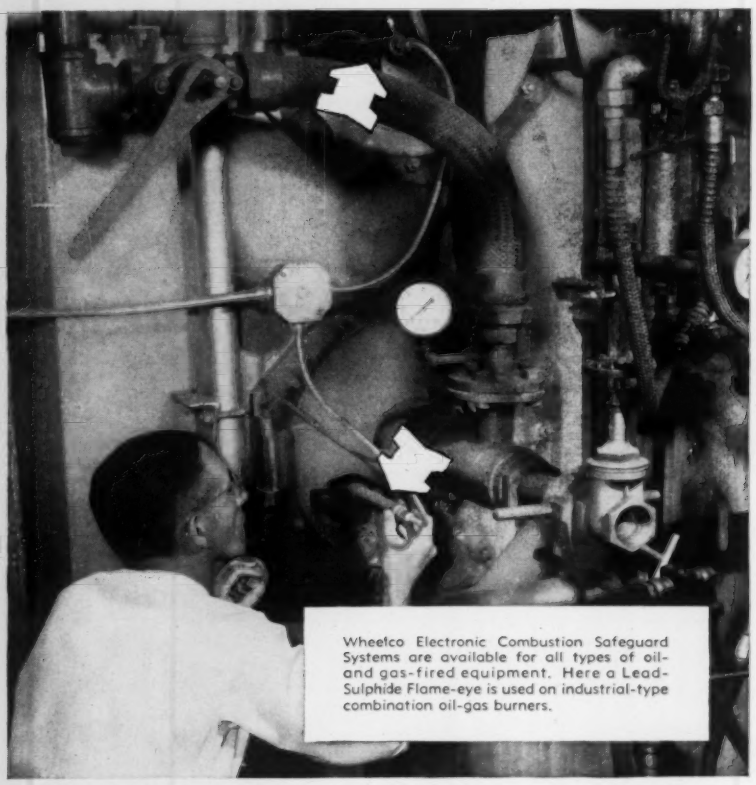
write for the complete Dewey & Almy story today

Kathabar®
HUMIDITY CONDITIONING

SURFACE COMBUSTION CORPORATION, TOLEDO 1, OHIO

BARBER COLMAN

New Wheelco Combustion Safeguard



Wheelco Electronic Combustion Safeguard Systems are available for all types of oil- and gas-fired equipment. Here a Lead-Sulphide Flame-eye is used on industrial-type combination oil-gas burners.

. . . with wide choice of sensing elements for oil- and gas-fired burners!

Regardless of the type of fuel used — gas, oil, or a combination of both — the broad selection of sensing systems available from Wheelco assures complete flame supervision and maximum protection against flame failure for furnaces, ovens, boilers, kilns, and dryers. To make specification of combustion safeguards even closer to the burner requirements, flexible circuit design of Wheelco Flame-otrols permits the use of auxiliary automatic controls, such as pushbutton starters and external timers for purging . . . as well as interlocking of multiple units in Control Center panels. Take advantage of these improved methods and instruments — your nearby Wheelco engineer can help you design and install combustion safeguards!

For safe-start firing of power boilers

Flame-otrols give you "safe-start" operation. A warm-up proving delay provides extended safety on initial starting, with a thermal delay plus conventional "safe-start" relay action. Wheelco Flame-otrols require no "wait period" between initial powering and a call for heat. Write for new Bulletin F-6570 illustrating advanced design features, circuit designs, and Wheelco Control Centers.

WHEELCO INSTRUMENTS DIVISION

Barber-Colman Company

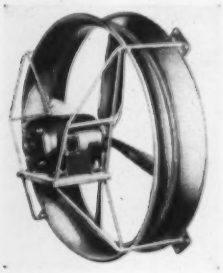
DEPT. U, 1501 ROCK STREET, ROCKFORD, ILLINOIS

BARBER-COLMAN OF CANADA, LTD., Dept. U, Toronto and Montreal, Canada

Industrial Instruments • Automatic Controls • Air Distribution Products • Aircraft Controls • Small Motors Overdoors and Operators • Molded Products • Metal Cutting Tools • Machine Tools • Textile Machinery

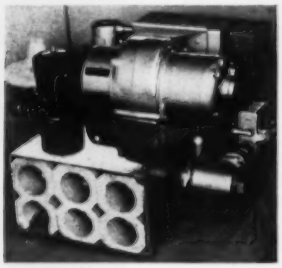
EQUIPMENT DEVELOPMENTS

Continued



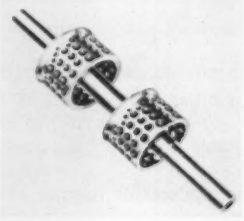
Reversible Fan . . .

. . . for ventilating jobs requiring intake sometimes, exhaust others—Hartzell Propeller Fan Co., Piqua, Ohio. Consists of aluminum alloy reversible propeller, two curved orifices welded face to face. In direct connected, belt drive, pulley drive, extension shaft models with 28, 36, 44 in. diameters.



Burners . . .

. . . for all-gas dual fuel conversion—Power-Flame Div. of Siemon Mfg. Co., Grandview, Mo. For commercial, industrial applications. In eight models with capacities 450,000 to 9 million Btu on natural, LP gas. Fuel switch-over done automatically, manually.



Plug Valves . . .

. . . designed to eliminate destructive vibration, trim deterioration, high noise level in flashing liquid service — Hammel-Dahl Co., 175

BARBER COLMAN

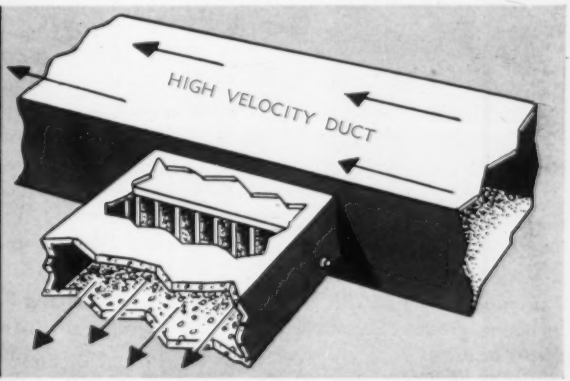
uni-flo Engineered Air Distribution

How high velocity air valves solve space and cost problems

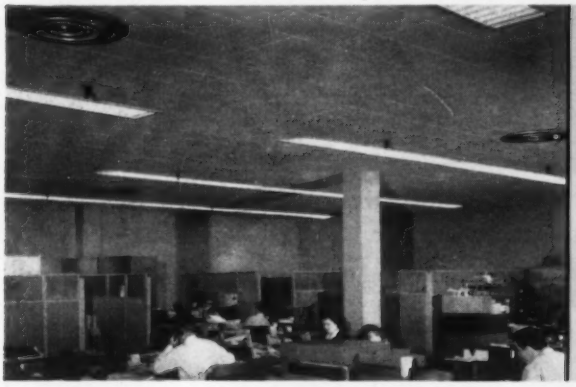
Several problems faced engineers planning a year-round, high velocity air conditioning system in this Morrison, Illinois, building after it was purchased by General Electric Company. The air conditioning system with all ten zone reheat coils had to be installed in a small equipment room. Ducts had to be located over existing suspended ceilings, without interfering with piping already in place. Efficient distribution at low noise level was the final objective—at a price within budget requirements. A trip to the Barber-Colman Laboratory convinced system designers that Uni-Flo Air Valves can be used at branch duct take-offs to deliver low velocity air to branches from high velocity trunk ducts. With all diffusers on each branch served by one air valve, and using a minimum of sound attenuation material, costs were reduced to meet budget figures.

Project Engineers—BOOTH BROTHERS AND COMPANY

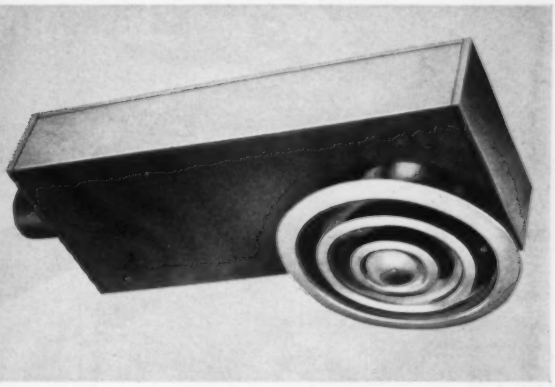
Two-story office building in Morrison, Illinois, acquired by General Electric Company. Space and cost problems arising from year-round air conditioning of an existing building were solved with a modern high velocity air distribution system, using Uni-Flo Air Valves.



Fewer Air Valves Are Required, Reducing Costs, because one Uni-Flo High Velocity Air Valve can be installed at a low velocity branch duct take-off from a high velocity trunk duct to serve several diffusers. This is a pioneer advantage of the Uni-Flo design.



Venturi-Flo Ceiling Diffusers harmonize with modern office decor, contribute efficient distribution of the conditioned air, free from drafts and disturbing noise. Each diffuser is individually adjustable for simplified balancing of the system. Pleasing results testify to sound engineering of the system.



A Uni-Flo High Velocity Control Unit is combined with a Venturi-Flo Ceiling Diffuser and made available as a "package" ready to attach in locations where it is desirable or necessary to continue high velocity to an individual diffuser.

BLAZING THE TRAIL TO BETTER AIR DISTRIBUTION

First with comprehensive, reliable, high velocity data

When Barber-Colman introduced the Uni-Flo Air Valve, results of laboratory tests on high velocity performance were released to the air conditioning industry. That reliable data enabled system designers to proceed with a greater number of satisfactory applications. Comprehensive performance data and design information for engineers are available in bulletin F-6598. You may obtain your copy by calling our nearby Field Office, or by writing us.

Barber-Colman Company

Dept. U, 1101 Rock Street, ROCKFORD, ILLINOIS, U. S. A.

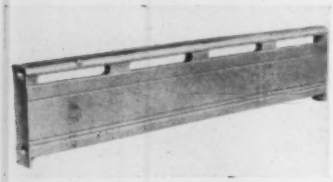
Field Offices in principal cities

Air Distribution Products • Automatic Controls • Small Motors
Industrial Instruments • Aircraft Controls • Overdoors and Operators
Molded Products • Metal Cutting Tools • Textile Machinery

EQUIPMENT DEVELOPMENTS

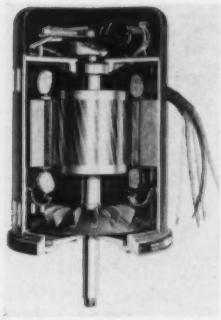
Continued

Post Rd., Providence 5, R.I. "Flash-Flo" has threaded holes spaced around plug skirt to create turbulence, distribute energy over large surface area. Turbulence converts potential energy directly to heat so less kinetic energy is present to damage piping. In sizes 3 to 16 in. Single or double seated.



Radiant Baseboard . . .

. . . offered in new sizes — Burnham Corp., Boiler Div., Irvington, N.Y. No. 9 is 9⅞ in. high, is IBR rated at 3.45 sq ft per lineal foot. No. 7 is 7 in. high, with 1.35 IBR rating. No. 9 offers greater radiating surface where heat losses greater, wall space at premium.

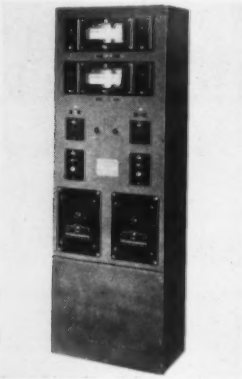


Jet Pump Motors . . .

. . . with fractional horsepower ratings—A. O. Smith Corp., Electric Motor Div., 227-231 Helena St., Dayton 4, Ohio. With totally enclosed canopy housing to protect against dirt, insects, rodents. Vent slots added to main frames provide controlled ventilation. In single, three phase models with ratings 1/3 to 2 hp. For horizontal, vertical application.

Lightweight Fittings . . .

. . . for gas distribution systems—Tube Turns, 224 E. Broadway, Louisville 1. Designed for use with lightweight piping now being used. In 3 to 24 in. sizes.



Control Center . . .

. . . for pathological incinerators—Wheelco Instruments Div., Barber-Colman Co., Rockford, Ill. Engineered to eliminate smoke, odor nuisances caused by improper combustion. Recommended by company for hospitals, research centers. Designed to control burners to maintain minimum (1600 F), maximum (2200 F) temperatures in incinerator.

Everybody NEEDS THIS NEW REED CHAIN WRENCH

HARDENED TOOL STEEL JAWS ARE REPLACEABLE
TURNS ANY SHAPE
Round ● Square ■
Hex ⬢ Odd
Ratchet action works either way from either side

IDEAL FOR CLOSE QUARTERS

works where an ordinary pipe wrench won't!

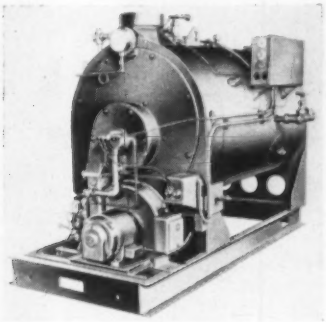
The Reed DU-ALL Chain Wrench does everything a conventional pipe wrench will do, and a great deal more. It gets into tight corners, close to baseboards or between parallel pipe lines, and holds round, square or irregular shapes . . . firmly, without "play" or crushing.

Its fast, ratchet action lets you tighten and "back off" without taking the wrench from the pipe.

All sizes of the DU-ALL wrench have ample chain length for fully tightening pipe up to the diameters handled by ordinary wrenches of equal lengths. Additional chain in the 14" model, however, gives the wrench a full working capacity up to 2" pipe and a holding capacity up to 4 inches. This is a major convenience in lining up soil pipe stacks, straightening studs, setting posts or turning any irregular shape within the leverage range of the 14" handle.

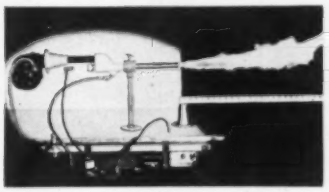
Whenever you want to work with pipe . . . ask for a REED Pipe Tool!

REED MANUFACTURING COMPANY • Erie, Pennsylvania



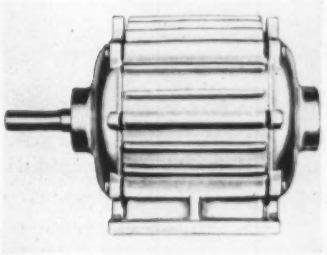
40 Hp Steam Generator . . .

. . . with compact package design—Cyclotherm Div., National-U.S. Radiator Corp., Oswego 6, N.Y. Measures 83 1/3 in. long, 57 3/4 in. high, 36 1/2 in. high at skids. Delivers 1380 lb per hr of steam. Has 1,340,000 Btu per hr output. Standard design pressures available 15 to 200 psi. Burns oil, gas or combination of both.



Gas Pilot Torch . . .

. . . for commercial, heavy oil industrial burners—Scully Signal Co., 174 Green St., Melrose 76, Mass. Emphasis placed on stability, reach, reliability. Projects flame to 25 in. Has integral motor driven air injection system to resist air turbulence.



Fan-Duty Motors . . .

. . . for industrial, commercial use—Lima Electric Motor Co., Lima, Ohio. In ratings 3/4 to 20 hp. Cited design features: double width prelubricated ball bearings; deep, integrally cast fins to provide greater heat dissipating surface; "Extra-margin" windings with heavy insulated wire with high dielectric, mechanical strength; optional connection boxes for specific motor applications.

NEW **WEINMAN**

type AC centrifugal pump for air conditioning systems

When outside atmospheres are laden with abrasive dust particles, recirculation of cooling water in air conditioning systems using cooling towers becomes a major maintenance headache. Shaft seals become worn far more quickly than normal and leakage occurs.

The Type AC pump was designed specifically by Weinman engineers to render long service under these conditions; in addition to a rotary type mechanical shaft seal, there is provided a reversible ceramic floating seat and carbon washer combination held by a stainless steel spring, insuring longer life and leakproof operation. The shaft is solid stainless steel, preventing rust or corrosion even when cooling water is chemically polluted.

CLOSE-COUPLED

MOUNTS IN ANY POSITION TO FIT REQUIREMENTS

Wherever thoroughly dependable, trouble-free circulation of hot or chilled water, pressure-boosting, or other general pumping needs are indicated, Weinman Type AC pumps will give superior service. If you have a pump problem, call your nearest WEINMAN Centrifugal Pump Specialist or write for Bulletin 725 . . . perhaps the Type AC pump is exactly what you need!

Representatives in principal cities.

Built by Centrifugal Specialists

The WEINMAN Pump Mfg. Co.

286 SPRUCE STREET • COLUMBUS 8, OHIO

USE PROPANE?

USE THIS TORCH-O-MATIC

USE ACETYLENE?

USE THIS TORCH-O-MATIC

Whichever Torch-o-matic you use —exclusive trigger-control saves you time, saves you fuel

With either the Propane or Acetylene Torch-o-matic, you get the *exclusive trigger-control* feature that saves time, saves gas, adds safety to every job.

The instant you pull the trigger, the flame lights, and you're ready to go to work. No matches, no adjusting, no time wasted. Release the trigger and the flame shuts off. And with the Propane Torch-o-matic, a special two-stage valve lets you increase the flame from a pinpoint to a full 6 inches in length simply by pulling the trigger completely back.

Add it up and you can quickly see how the AUTOMATIC ON-OFF trigger-control puts you ahead when you're using Torch-o-matic, saves you gas when you're not.

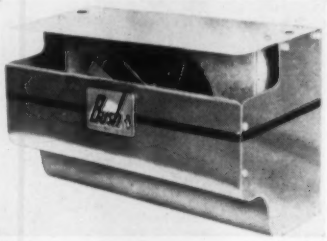
The Acetylene Torch-o-matic fits your present equipment, features a wide selection of nozzles for every job. The Propane Torch-o-matic connects directly to your propane tank—no intermediate valve fittings are necessary. Write for details.

VELOCITY POWER TOOL CO.

[redacted]

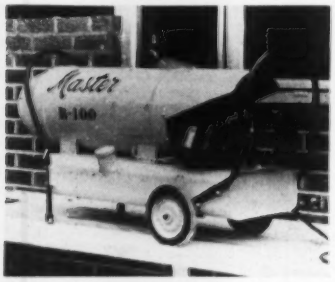
EQUIPMENT DEVELOPMENTS

Continued



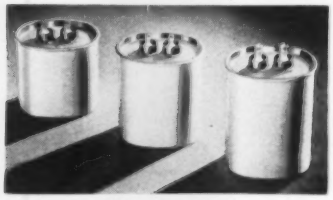
Unit Coolers . . .

. . . with stainless steel cases, nonferrous construction—Bush Mfg. Co., 179 South St., West Hartford, Conn. Feature company's "Inner-Fin" coil construction to permit smaller coil. Units operate suck-through or blow-through. Can be wall or ceiling mounted.



Portable Heater . . .

. . . for space heating in construction—Master Vibrator Co., 362 Stanley Ave., Dayton 1, Ohio. Weighs 78 lb without fuel. Has 100,000 Btu per hr capacity. Blows 500 cfm of warm air. Runs from 110-115 volt, 60 cycle a-c current. Burns kerosene, Nos. 1 or 2 fuel oil.



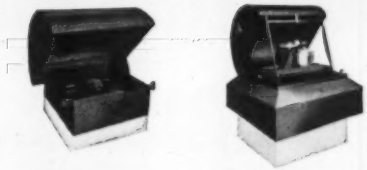
Capacitors . . .

. . . with drawn oval design for air conditioning, refrigeration, fan motors, similar applications—Potter Co., 1950 Sheridan Rd., North Chicago, Ill. Available for 236, 330, 440 volts a-c, 60 cycles. In seamless cases. Cases filled with chlorinated diphenol resin, formulated for high dielectric qualities. Terminal types: quick connect, eyelet, fork—each for conventional or barrier type mounting.

Stainless Fittings . . .

. . . for corrosive applications—Ladish Co., Tri-Clover Div., Kenosha, Wis. "Tri-Clamp" consists of flange type ferrule (special gasket which fits into grooved ferrule

The MASSACHUSETTS Line



OUR 76TH YEAR

POWER ROOF VENTILATORS, Propeller Fan Type and Power Fixed (backward curve blade) offer a wide range of sizes. Bulletin No. 119 Propeller Fan Type Bull. 124 Power Fixed Fan Type.

BLOWERS, Squirrel Cage (Forward Curve) and Power Fixed (Backward Curve) Fans available in a complete range of sizes, Single or double width. Bulletin 101 (PF) Bulletin 105 (S.C.).

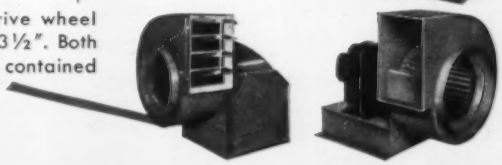
FURNACE FANS, Single, double or special width. All housing and wheel parts are die formed. Available as complete assemblies or parts only. Bulletin No. 115.

UNIT HEATERS, Blower Type floor or ceiling mounting arrangements, built in sections to facilitate efficient handling and erection. Popular sizes. Bulletin No. 112.

PROPELLER FANS, New Venturi-type Belt drive 24" to 48" wheel diameters, direct drive 12" to 30" diameters. A complete line of accessory items are available. Bulletin 117.

UNIVERSAL BLOWERS, A stock blower assembly made in single or double width, sizes 7" to 27" wheel dia. and features Universal discharge arrangement. Bulletin No. 110.

AIR CONDITIONING UNITS, Seven sizes available, ranging from 1,000 to 14,000 C.F.M. Vertical or horizontal mounting. Designed to combine cooling in summer, heating in winter. Bulletin 120.



VENTILATING SETS, Utility type. Belt drive wheel diameters 7" to 30". Direct drive 6" to 13½". Both available in popular competitive sizes, self contained completely packaged units. Bulletin 109.

MASSACHUSETTS BLOWER DIVISION

The BISHOP & BABCOCK Mfg. Co.

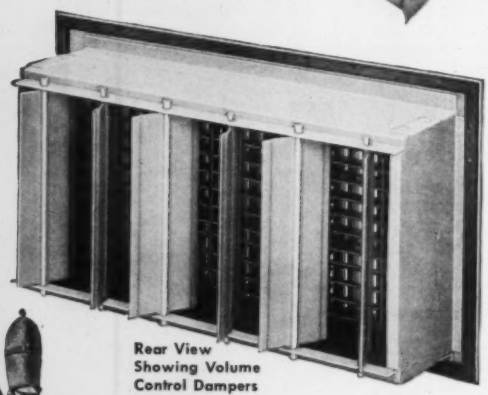
4901 HAMILTON AVENUE · CLEVELAND 14, OHIO

INDEPENDENT

"Fabrikated"

DOUBLE CORE REGISTERS
with opposed blade dampers
key control
For Commercial Installations

No. 27
Adjustable Vertical Front Bars
Adjustable Horizontal Rear Bars



Rear View
Showing Volume
Control Dampers

Write for Bulletin
No. 54-A which gives
complete details and sizes
up to 48″ x 24″

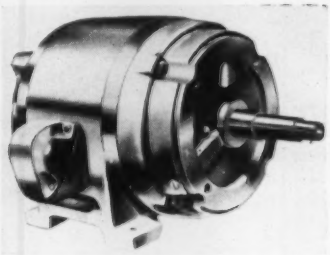
Always Leading—
Always Progressing

THE INDEPENDENT
REGISTER CO.
3747 E. 93rd STREET • CLEVELAND, OHIO

EQUIPMENT DEVELOPMENTS

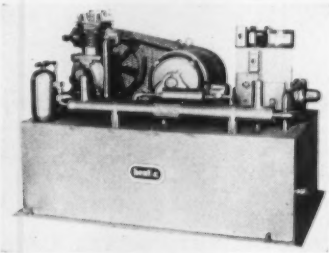
Continued

lip) and fitting itself. Installation is by attaching ferrules to stainless steel tubing or pipe, inserting gasket into position, slipping fitting over ferrules and gasket, tightening into position.



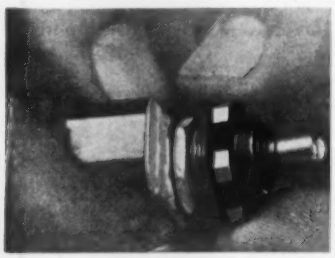
Motor . . .

. . . with face type registered bracket, special shaft for close coupled centrifugal pump applications—U.S. Electrical Motors, Inc., Box 2058, Terminal Annex, Los Angeles 54. Built to rerated NEMA specifications, is more compact. Pump may be mounted flush with motor by bolting to face bracket. Has solid flange and brass slinger to protect motor from water. In ratings 1 to 30 hp.



Packaged Coolers . . .

. . . for process water, low viscosity liquids—Heat-X, Inc., Brewster, N. Y. Recommended by company for industries where large volumes of low temperature water required. Available with stainless steel circuits for subcooling Freons, cooling kerosene and light oils. In capacities 1/3 to 10 hp.



Panel Seal . . .

. . . for toggle switches — Panseal, Inc., 10 Main St., Little Ferry, N.J. Designed to seal out water, dust, moisture, explosive or combustible liquids or gases.

BRUNER
WATER SOFTENERS & FILTERS

for Industrial Installations

Hundreds of Bruner Industrial Water Softener installations are proving their superiority in military bases, industrial plants, hotels, hospitals, schools and colleges in all parts of the United States, Canada, Alaska and South America.

Examples of Bruner industrial installations:

SCHOOLS AND COLLEGES
University of Wisconsin — Madison, Wis.
University of Missouri — Columbia, Mo.
Peabody High School — Trenton, Tenn.

HOTELS AND HOSPITALS
Jung Hotel — New Orleans, La.
Gulf Bay Hotel — Sarasota, Fla.
Athens State Hospital — Athens, O.

INDUSTRIAL
Chevrolet Division GM — Flint, Mich.
Halle Bros. Dept. Store — Canton, O.
Havana Laundry — Havana, Cuba
General Electric Co. — Bloomington, Ind.

MILITARY
Wright Patterson Air Force Base — Dayton, O.
Big Spring Air Force Base — Big Spring, Tex.

There are Bruner Sales and Engineering offices in principal cities. Your inquiry will receive immediate attention.

Manual and Fully Automatic softeners in capacities up to 1,500,000 grains are carried in stock. Larger capacities and special equipment to treat unusual water conditions engineered to meet your requirements.

BRUNER WATER SOFTENERS & FILTERS

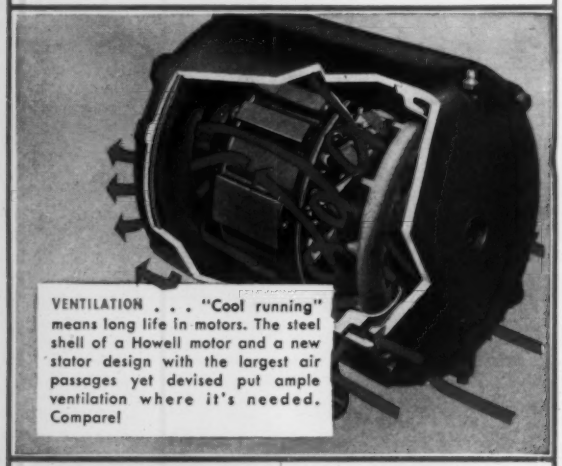
BRUNER Corporation
4763 N. 32nd Street • Milwaukee 16, Wisconsin

Sales Offices in Principal Cities • Plants in Milwaukee and Santa Barbara

To AIR CONDITIONING ENGINEERS,
Howell suggests

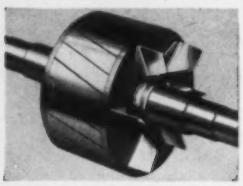
What to look for in Weather-Protected motors

Want pump or compressor motors with all the space and weight-saving advantages of the NEMA re-rated frame size plus labyrinth-type ventilation to make them truly weather protected? Below are some points for comparison and a few of the reasons why the new Howell "Series 100" motors are so outstanding!



VENTILATION . . . "Cool running" means long life in motors. The steel shell of a Howell motor and a new stator design with the largest air passages yet devised put ample ventilation where it's needed. Compare!

BEARINGS . . . They should be fully protected. Dirt can't enter Howell's double shielded bearings either from inside or outside the motor, because they are sealed in the end plate cavities by dust-tight inner caps. Compare!



COPPER-CLAD ROTORS . . . Howell motors have copper-wound rotors. This means better heat conductivity, stability at high temperatures and, as opposed to die-cast rotors, greater design flexibility to meet your special requirements. Compare!

New Series 100 motors are SMALLER • LIGHTER • COOLER • MORE STREAMLINED. Available in Weather-Protected, Open Drip-Proof (illustrated Left) TEFC, and Explosion-Proof enclosures.

Write for Bulletins N-100-E and WP-1

Precision-Built Motors for Industry Since 1915

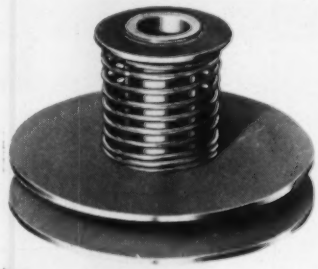
HOWELL MOTORS

HOWELL Red Band motors

EQUIPMENT DEVELOPMENTS

Continued

Also acts as lock nut to secure switch to panel. Silicone base membrane has −60 to 200 C temperature range.

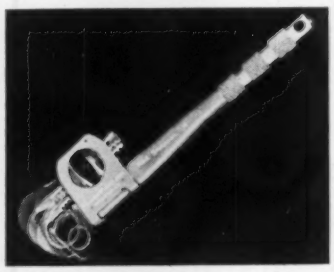


Variable Speed Pulley . . .

. . . for power transmission—Lovejoy Flexible Coupling Co., 4987 W. Lake St., Chicago 44. Is $^{3}/_{4}$ hp type. Can be adapted to new or old equipment. Nonlubricated due to use of oil impregnated bronze bearings. Delivers speed ratio to $2^{3}/_{4}$ to 1. Minimum bore is $^{7}/_{8}$ in. with keyway.

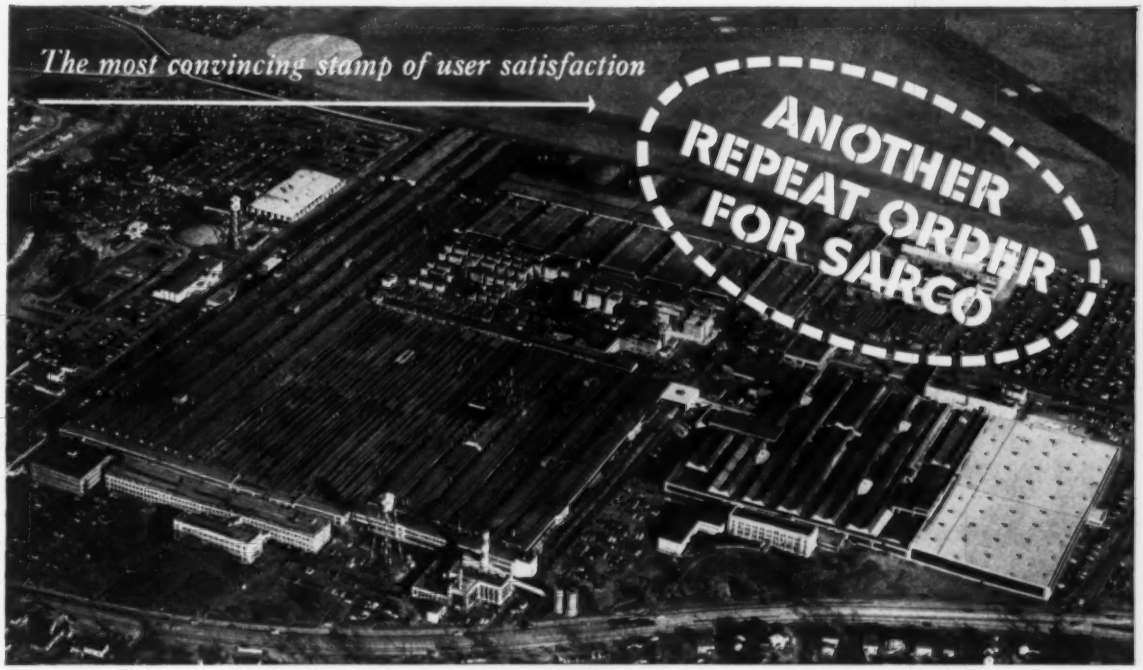
Pneumatic Thermostat . . .

. . . with spherical shape operates on force balance, continuous feedback principles — Minneapolis-Honeywell Regulator Co., Wayne and Windrim Aves., Philadelphia 44. Force balance principle provides air pressure signal for given temperature deviation detected by sensing element. Larger, low mass bimetal sensing element designed for fast response to temperature changes.



Pipe Wrench . . .

. . . with new features—Stilsomatic Sales Corp., 1100 20th St., N.W., Washington 6, D.C. Has tubular steel construction, is automatic adjusting with rocking fulcrum



Main offices and plant of Pratt & Whitney Aircraft, East Hartford, Conn., in which Sarco Heating Specialties are installed. These Sarco products are used by all divisions of United Aircraft Corporation.

35 repeat orders from United Aircraft

for Sarco Heating Specialties!

First installation in 1933. Thirty-five installations since. That's the 22-year record of Sarco Heating Specialties in plants and office buildings of all United Aircraft Divisions.

35 *large* repeat orders... won by Sarco proved dependability!

Several thousand Sarco steam traps and other Sarco Heating Specialties are on the job at:

Pratt & Whitney Aircraft Div., East Hartford, North Haven and Southington, Conn., *Hamilton Standard Division*, Windsor Locks, Conn., *Sikorsky Aircraft Division*, Bridgeport and Stratford, Conn.

For further information on Sarco heating specialties, Sarcotherm weather-compensated control systems for steam and hot water heating, and Sarcofin finned-tube and baseboard radiation, write Sarco Company, Inc., Empire State Building, New York 1, N. Y.

SARCOfin Radiation

...another Sarco product

APPROVED RATINGS—by Institute of Boiler and Radiator Manufacturers for finned-tube and baseboard radiation.

1-YEAR GUARANTEE against defects in materials and workmanship.

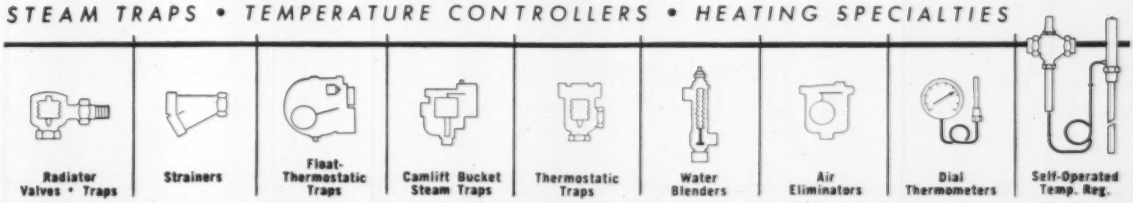
COOPERATION—careful selection of radiation by experienced Sarco and Sarcotherm heating engineers.

Write for Bulletins

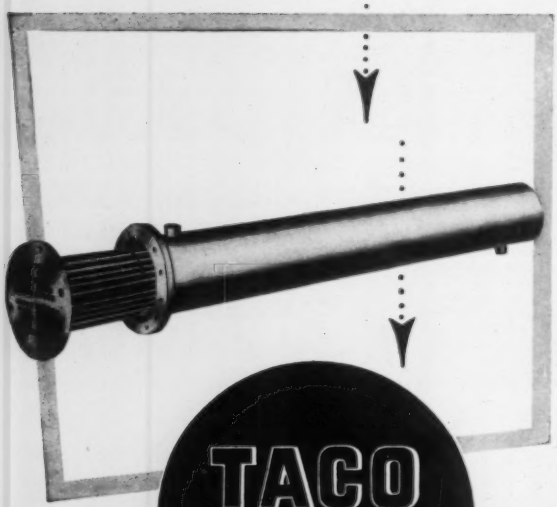
SARCO

Sarco quality assures satisfaction

STEAM TRAPS • TEMPERATURE CONTROLLERS • HEATING SPECIALTIES



easy solution to tough specifications



TACO Heat Exchanger

Whatever your requirements — simple or complex — Taco can supply you immediately with the right heat exchanger! TACO know-how will help you select the heat exchanger you can depend upon to do the job right!

Engineered for top performance, minimum maintenance, and built to exacting standards through quality controlled manufacturing. Call or write for complete information.

Condensate Coolers • Converters • Chillers • Circulating Pumps
Fuel Oil Heaters • Oil Coolers
Radiation Heaters • Tank Heating Units • Water Heaters

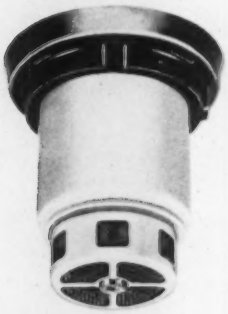
TACO HEATERS, INCORPORATED
1160 Cranston Street
Cranston 9, R. I.

Taco

EQUIPMENT DEVELOPMENTS

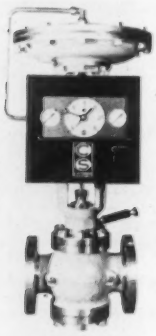
Continued

action, has spring loaded hook jaw, is light in weight. "Red Snapper" available in 12, 14, 18 in. sizes. Larger 24, 36, 48 in. models in production.



Detector System . . .

. . . designed to detect fire in early stages, without visible smoke or heat—Pyrene—C-O-Two, Newark 1. Predetector heads containing radioactive element actuate visual, audible alarms. Locates smallest smoldering fire, says company.



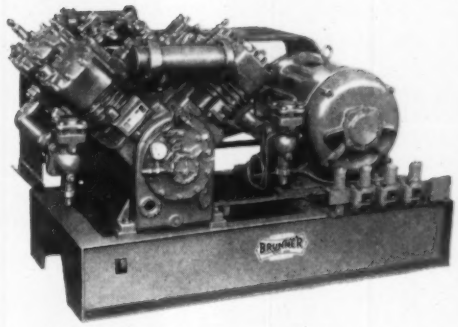
Pilot . . .

. . . for controlling pressure, temperature—A. W. Cash Co., P.O. Box 551, Decatur, Ill. Applicable for pressure ranges 0-15 to 0-10,000 psi, 0-30 in. H_2O and 0-30 in. Hg vacuum. Pressure sensing elements available in phosphor bronze, beryllium copper, or stainless steel. For temperatures −40 to 1000 F, with mercury actuated armored capillary temperature sensing element with plain bulb, union connection or union connection with separate socket.

Oil Fired Heaters . . .

. . . for suspended "space saver" installation—Armstrong Furnace Co., 851 W. Third Ave., Columbus, Ohio.

Brunner planned it that way...



BRUNNER CONDENSING UNITS

. . . for remote air conditioning installation in commercial and industrial applications, are supplied in sizes up to 75 H.P. with capacity control. Brunner Compressor Units for use with evaporative condensers also available up to 75 H.P.

BRUNNER AIR CONDITIONERS

. . . completely self-contained, are available in various models up to 20 H.P. for residential or business installations. Easy to install, cost less to operate.

By choosing BRUNNER for dependable performance, thousands of users of Brunner Air Conditioners and Refrigeration Condensing Units have put their OK on Brunner quality.

This is not just a lucky coincidence . . . we planned it that way! Right at the beginning, we made up our minds that we were interested in producing only the best . . . and we've held to this objective for half a century.

Brunner "OK quality" is built into the product, step by step, from start to finish . . . pays off in finer performance, more years of trouble-free service, and lower operating costs. "SELL BRUNNER" with complete confidence that you are serving the best interests both of your customers and yourself.

Brunner offers a complete line of Refrigeration and Air Conditioning Condensing Units and Packaged Air Conditioners. See your Brunner representative, or write to:

BRUNNER MANUFACTURING COMPANY, Dept. L-955, UTICA, N.Y.
The Brunner Co., Gainesville, Ga.
In Canada: Brunner Corp. (Canada) Limited, Toronto, Ontario

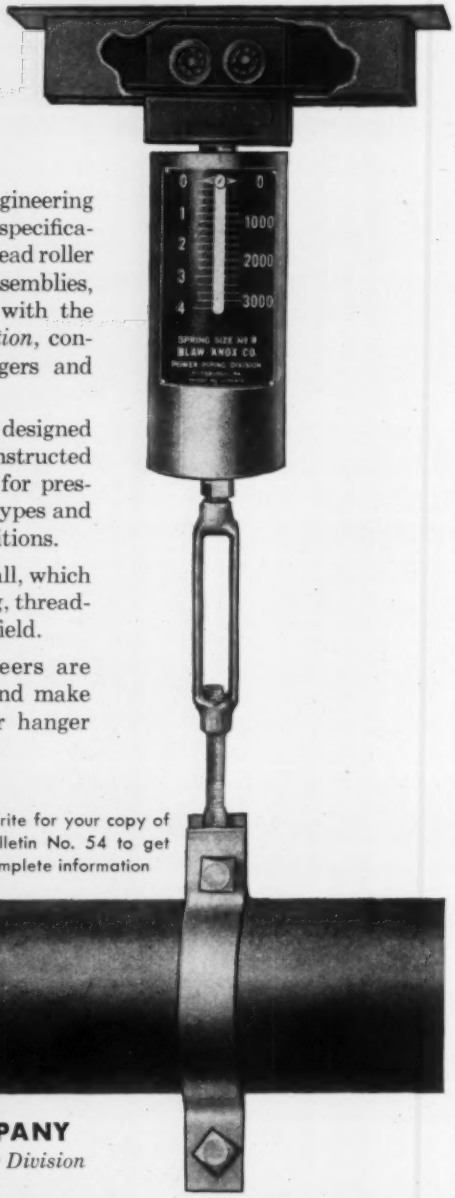
BRUNNER SINCE 1906

BRUNNER EXTRAS

- Compressor Experience
- Product Research
- Design Engineering
- Wide Product Range
- Proven Quality
- Complete Dependability
- Easy Servicing
- Warranted Performance
- Nearby Distributor Service
- Profit Opportunity
- Advertising Support
- Sales Promotion Help

you save engineering time

with complete hanger assemblies



To save many hours of engineering time and to speed up your specifications, use Blaw-Knox overhead roller assemblies, rigid hanger assemblies, functional spring hangers with the patented *internal swivel action*, constant support spring hangers and vibration eliminators.

Each is a complete unit, designed for a specific purpose. Constructed to comply with the "code for pressure piping." Available in types and sizes to meet varying conditions.

And each is ready to install, which eliminates expensive cutting, threading and assembling in the field.

Our experienced engineers are available to both design and make recommendations for your hanger requirements.

Write for your copy of Bulletin No. 54 to get complete information

BLAW-KNOX COMPANY
Power Piping and Sprinkler Division
Pittsburgh 33, Pennsylvania

BLAW-KNOX

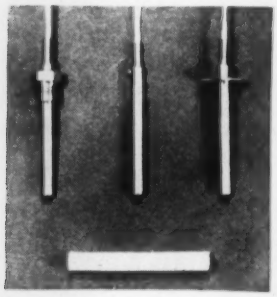
PIPE HANGERS

Complete line of functional spring hangers • constant support spring hangers • rigid hanger assemblies • overhead roller assemblies • supports • vibration eliminators . . . plus complete prefabricated piping systems for all pressures and temperatures

EQUIPMENT DEVELOPMENTS

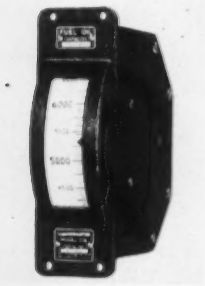
Continued

In three models rated 225,000 to 350,000 Btu per hr. Cited applications: churches, schools, restaurants, service stations, garages. Designed for simple installation.



Midget Thermostats . . .

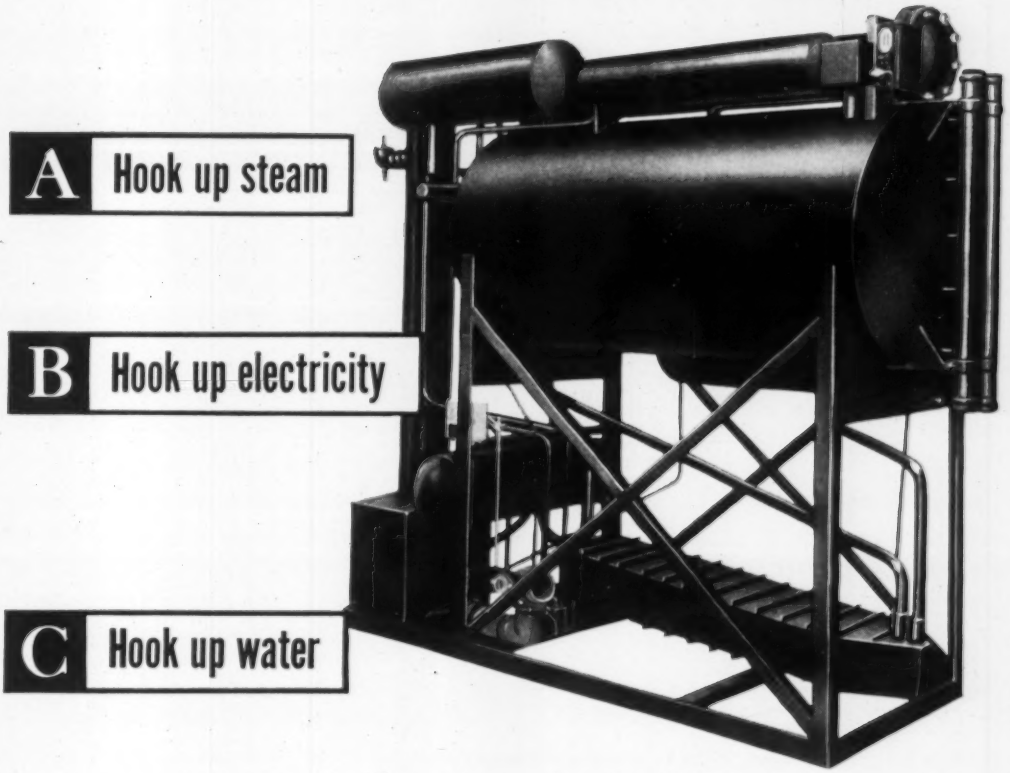
. . . designed for precise temperature control, heat detection applications in heated equipment, bearings, pumps, etc., where space is at premium—Fenwal, Inc., Ashland, Mass. Has ¼ in. diameter, is less than 2½ in. long. May be set to actuate temperatures –50 to 500 F. Rated to handle 1 amp, 115 volt a-c electric load.



Remote Indicator . . .

. . . designed to automatically read liquid tank contents — Liquidometer Corp., 41-03 36th St., Long Island City 1, N.Y. For applications where panel space limited. Is dial type for horizontal, vertical panel mounting. For use with company's hydraulic actuated tank contents gaging system. System consists of indicator, float type tank unit connected by flexible conduit containing two hydraulic capillary tubes. Indicator may be located to 250 ft from tank unit, says company.

NEW! Servel water chiller is easy to hook up as A B C



Now! Servel offers you a package water chiller, complete and ready for installation.

Simply hook up steam supply and return to operate absorption refrigeration unit. Connect electricity, 115-volt AC, to operate controls. Then connect chilled water and condensing water systems.

All operating and safety controls are engineered specifically for Servel water chillers and installed at the factory. This eliminates the necessity of control design engineering and local procurement of special controls.

Capacity of water chiller is modulated to meet your needs up to a full 25 tons. Equipment is controlled to assure peak efficiency for lowest operating cost.

Servel water chillers are now serving industry by

Dissipating heat of process machines:
Rubber mills and mixers, wax mills, printing equipment

Removing heat of chemical reactions:
Anodizing, electroplating

Condensing volatile chemicals:
Soya bean processing, natural gas producers

Cooling product after processing:
Canning factories, bottling plants

Temperature and humidity control:
Sugar refineries, printing plants, textile mills, precision machining

Comfort air conditioning:
For factories and offices

Servel

the name to watch for great advances in

AIR CONDITIONING ∨ REFRIGERATION

SERVEL, INC., Dept. HP-95, Evansville 20, Indiana

Please send me specifications and full information on new water chiller with packaged control.

Name_____

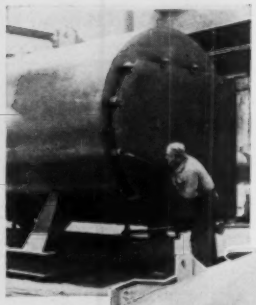
Firm_____

Address_____

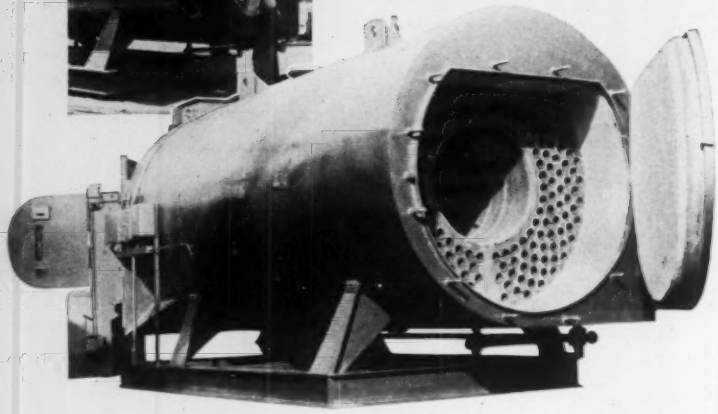
City_____ Zone_____

County_____ State_____

ACCESSIBILITY



is built into the
Continental
BOILER



. . . saves production time
. . . saves maintenance dollars

Rugged, simple in design, accessible—that's the Continental Automatic Boiler. Here are a few reasons why it's easy to keep this packaged steam generator at peak efficiency:

- Openings are provided to facilitate inspection of steam and water space.
- Both front and rear doors are hinged—affording quick access to furnace and return tubes.
- Cleaning, when necessary, is easy. One man can open both doors in a matter of minutes.

AND HERE'S WHY CONTINENTAL BOILERS STAY EFFICIENT FOR A LONG TIME:

- 2-pass design eliminates refractory baffles in front and rear which may burn out, leak and cause short circuit of gases.
- *All* return tubes are subjected to the same temperature and do equal work . . . and there is more uniform longitudinal expansion of the pressure vessel.

Send for Bulletins BE3-4 . . . and let us bid on the next boiler you need.

Used for high or low pressure steam and for hot water applications, Continental Boilers are fully automatic, range from 20 to 500 hp. and can be gas, oil or combination fired. Over 80% efficiency is guaranteed.

Continental AUTOMATIC BOILERS

BOILER ENGINEERING
and Supply Company, Inc.

8 Manavon Street
Phoenixville, Pa. Phone 5832

EQUIPMENT DEVELOPMENTS
Continued

Low Water Cutoff . . .

. . . with new design to provide increased boiler protection—Econo Products Co., East Haddam, Conn. Different from mechanical float type, has no moving parts to fail, clog or jam, says company. Operates electrically using porcelain electric probe recorder. Low water level signalled by red light, audible alarm.

Equipment Briefs . . .

SHAFT SEAL for vacuum pumps—Minnesota Rubber and Gasket Co., 3630 Wooddale Ave., Minneapolis 16. "Quad-Ring" designed to eliminate spiral twist failures, rolling with pulsating pressure, torque leakage at low pressure differentials.

LOW FUMING BRONZE RODS for maintenance, production brazing—All-State Welding Alloys Co., Inc., White Plains, N.Y. Are flux coated, low fuming bronze in 36 in. lengths. For 1650 F. Deposits develop 60,000 psi tensile strength.

ASBESTOS SHEET PACKING for industrial gasket requirements—Thermoid Co., Trenton, N.J. For handling steam, water, brine, air, oil to 300 psi, 500 F. Cross laminated material has 4500 psi tensile strength, homogenous packing has 3000. In 1/32, 1/16, 1/8 in. thicknesses.

RUBBER COVERING TECHNIQUE for metal castings—Willow Run Rubber and Lining Co., Belleville, Mich. Designed for holding covering to specific parallel depths.

SelecTemp room units, only 18 inches high, are recessed into wall and can be painted to match color scheme. Three sizes: 6,000, 12,000, and 18,000 Btu output. 12,000 Btu size shown below. No electric wiring or power is used. Small flexible copper tubes carry steam to each room unit.

Why Iron Fireman® SelecTemp® is the greatest advance in modern heating

This Quick Quiz Tells Story

Features never before available bring new heating standards to apartments, hospitals, motels, office buildings, schools and other buildings of every size and type.

Q. What features are new and better in Iron Fireman SelecTemp heating?

A. (1) Thermostat in every room; (2) modulated (not "on-off") heat; (3) filtered warm air continuously circulated; (4) easily installed in new or old construction; (5) boiler can be located anywhere; (6) moderate operating costs.

Q. How does SelecTemp provide individual room temperature control?

A. Each room heating unit has its own thermostat. Temperature in any room, including bathrooms, can be raised or lowered without affecting temperature in any other rooms.

Q. What is meant by "modulating" heat?

A. SelecTemp is not "on-and-off" heating. Each room unit automatically modulates its own heat output. Steam turbine operated fan in each unit runs faster or slower, according to amount of heat needed, gently circulating filtered warm air.

Q. What happens when south rooms face warm sunshine and north rooms face cold winds?

A. SelecTemp heaters in the rooms affected act at once, adjusting heat output to the needs of the individual rooms. Heating units on the warm side of the building slow down to compensate for solar heat, while those on the cold side increase heat delivery to make up for extra heat loss. SelecTemp units mounted in outside walls quickly sense temperature changes and automatically increase room temperature to keep comfort level constant. Reaction is fast and accurate—no outside thermostats required.

Q. Is SelecTemp reasonable in cost?

A. Yes. The system is engineered for very economical installation and operation, both in new construction and modernization. SelecTemp, a new, different and revolutionary kind of heating, is one of the most desirable features you can put into any type of building where human comfort is involved.

SEND FOR FREE SELECTEMP BOOKLET . . .

Contains complete description, with specifications for builders and architects. Use coupon below.

Iron Fireman®

SelecTemp®

MODULATING ZONE HEATING

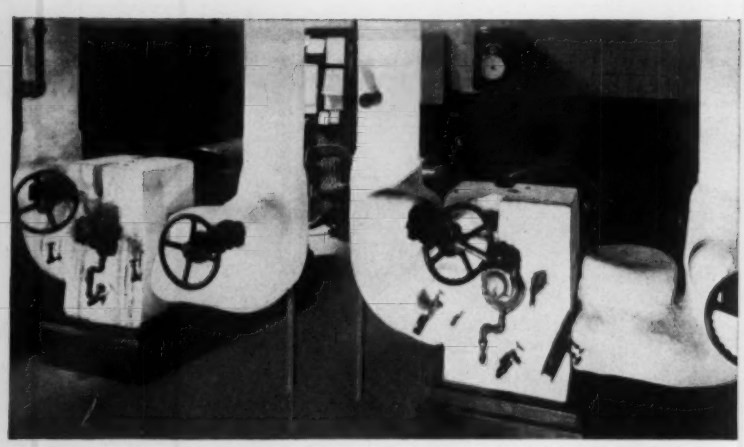
Iron Fireman Manufacturing Company
3063 W. 106th St., Cleveland 11, Ohio.
In Canada: 80 Ward St., Toronto, Ontario.

Please send free descriptive booklet on SelecTemp heating.

Name _____

Address _____

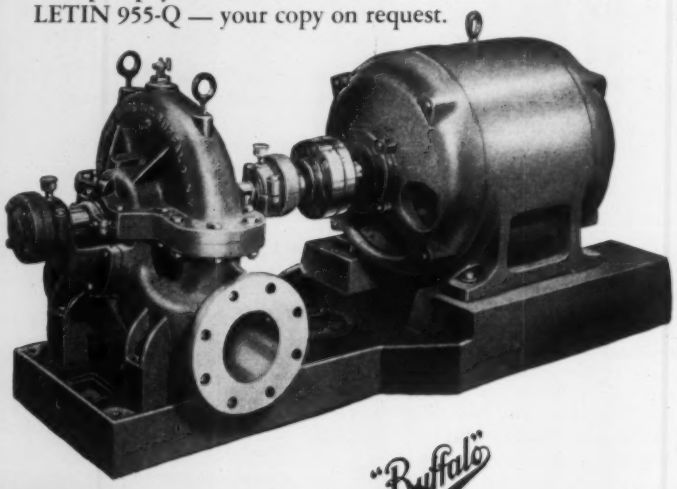
City _____ State _____



UNDER THE INSULATION

— You Want a Pump You Can Trust

Pumps are by no means the most expensive equipment in a refrigeration or air conditioning system like the above — yet the system can function no better than the pumps. Here, certainly, is no place to cut corners. "Buffalo" Type SL Double Suction Pumps have a built-in efficiency and reliability that makes them the SAFE choice for clear water installations. We call this construction the "Q" Factor*. It's been a part of "Buffalo" Pumps for 78 years — and in countless liquid moving jobs, "Buffalo" has proven to be "the pump you can trust."FULL DETAILS IN BULLETIN 955-Q — your copy on request.



"Buffalo" PUMPS

TYPE SL DOUBLE SUCTION PUMP

*The "Q" Factor — the built-in Quality which provides trouble-free satisfaction and long life.

BUFFALO PUMPS, INC.

171 Mortimer St., Buffalo N. Y.
SUBSIDIARY OF BUFFALO FORGE COMPANY
Canada Pumps, Ltd., Kitchener, Ont.
Sales Representatives in all Principal Cities

A BETTER CENTRIFUGAL PUMP FOR EVERY LIQUID

EQUIPMENT DEVELOPMENTS

Continued

STEP STARTING ACCESSORY for 3 and 5 hp air conditioning units —General Electric Co., Schenectady 5, N. Y. Designed to reduce flicker in lighting circuits. Reduces starting currents by about 50 percent, says company.

FLUOROCARBON PLASTIC DIAPHRAGMS for valves, controls, piping, process equipment—Resistoflex Corp., Belleville, N.J. For applications involving acids and caustics, food and drugs, hot lacquers, steam, synthetic oils, jet fuels, gases, vapors.

TIME DELAY RELAYS for proportional delayed reset after current interruption—A. W. Haydon Co., Waterbury, Conn. Function is to delay application of plate voltage in gas, vacuum power tubes until filaments reach proper temperature.

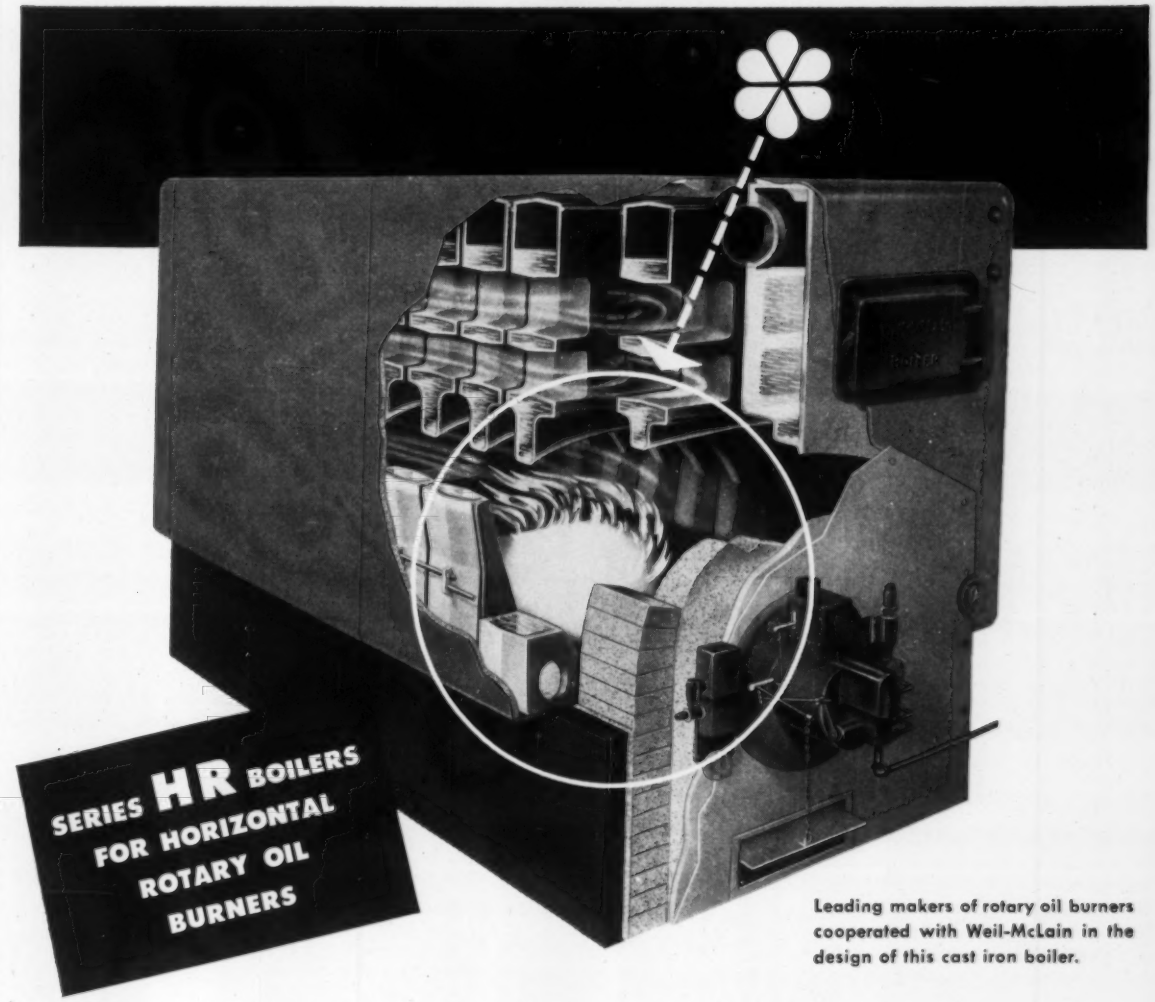
TORCH KIT for jobs requiring heat and flame—Otto Bernz Co., Inc., 280 Lyell Ave., Rochester 6, N.Y. Kit contains cylinder of propane gas, pencil flame burner unit, utility burner head, flame spreader for use with utility burner, soldering tip.

RELIEF VALVES with increased capacity ratings in ½ to 1 in. sizes —Henry Valve Co., 3215 North Ave., Melrose Park, Ill. Carry official marking symbol indicating ASME approval and capacity certification.

WATER HARDNESS TESTING KIT for determining when softeners need regenerating—Calgon, Inc., 323 Fourth Ave., Pittsburgh. Consists of glass vial, dropper bottle of softener reagent. Drops change color in water to indicate hardness.

COMPOUND formulated for resistance to refrigerants—Goshen Rubber Co., Inc., Goshen, Ind. Recommended by company for seals, mechanical parts.

DRAFTING TEMPLATE for engineers, designers, draftsmen—E-Z Way Templates, 1321 19th St., Santa



Leading makers of rotary oil burners cooperated with Weil-McLain in the design of this cast iron boiler.

Within the circle above, you'll find the features which make the Weil-McLain HR Series Boiler a revolutionary advance in heavy oil burning efficiency.

Note first the fire box. Its extra large combustion volume assures lower heat release per cubic foot... maximum radiant heat transfer...higher CO_2...and more complete, smoke-free combustion. Large waterways permit rapid, efficient water circulation through the boiler.

The heavy steel front plate is a special feature which greatly simplifies burner installation. It is furnished blank with a scribed center line for easy location of the various openings required. Or, if requested, the factory will furnish the plate drilled and tapped to specification.

HR Series Boilers have sturdy steel, green enamelled jackets lined with heavy density fibre glass...saves insulating time on the job.

This boiler is built of rugged *cast iron*—strongly resistant to the corrosive effects of the large sulphur content of heavy oils. Its sectional construction and short individual draw rods assure easier erection and a more flexible assembly. Note, too, the high base—it eliminates a high brick foundation.

WEIL-McLAIN

For complete information, send for Bulletin No. C-188

WEIL-McLAIN
BOILERS · RADIATORS

WEIL-McLAIN COMPANY
MICHIGAN CITY, INDIANA

Address literature requests to Dept. AA-95

an ACCO product

Wedge Gates from 2" to 24"

—FROM R-P&C's COMPLETE LINE OF IRON BODY VALVES

• Thousands of these **Fig. 625** iron body wedge gate valves, in hundreds of different services, are giving the dependable economical service which has come to be synonymous with R-P&C. Rated for 125 lbs. Steam—200 lbs. OWG in sizes up to 12", and for slightly lower pressures in larger sizes, they are regularly furnished with bronze trim for use with steam, water, oil or gas. Also provided in all-iron for use with fluids which attack bronze.

• Their record for dependable service and low maintenance requirements is shared by R-P&C's complete line of iron body valves—gates, globes, angles, checks and cocks in a complete range of sizes, body styles and pressure classes up to 250 lbs. All are made from castings of special fine-grained, high test, cast iron —50% stronger than ordinary cast iron. Precision manufacturing and step-by-step quality control result in tight closures, easy operation and longer wear.

See your R-P&C distributor or write for catalog

ACCO TRADE MARK

R-P&C Valve Division
AMERICAN CHAIN & CABLE

Reading, Pa., Atlanta, Boston, Chicago, Denver, Detroit, Houston, New York, Philadelphia, Pittsburgh, San Francisco, Bridgeport, Conn.

R-P&C valves

EQUIPMENT DEVELOPMENTS

Continued

Monica, Calif. "Slide-A-Square" permits quick drawing of squares to 3 in. Calibrated in decimals, fractions, metric system. Vinyl plastic construction.

PORTABLE GENERATOR modified for welding service—D. W. Onan & Sons, Inc., Minneapolis. Lightweight 2500 watt unit designed to operate any transformer type a-c welder to 150 amp rating.

CIRCULATOR designed to return gases from fringe of flame through core of heat, to achieve complete combustion—C. R. Daniels, Inc., Daniels, Md. Produces to 175,000 Btu per hr. Burns less than 1 gal per hr of fuel, says company.

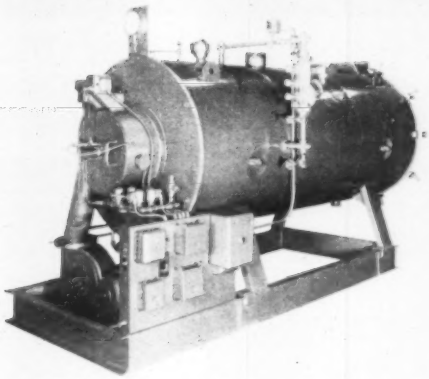
AIR CONDITIONING EQUIPMENT now factory preassembled—Drayer-Hanson, Inc., Box 2215, Terminal Annex, Los Angeles 54. Previously shipped as three sections — fan, coil, plenum.

Don't sit back

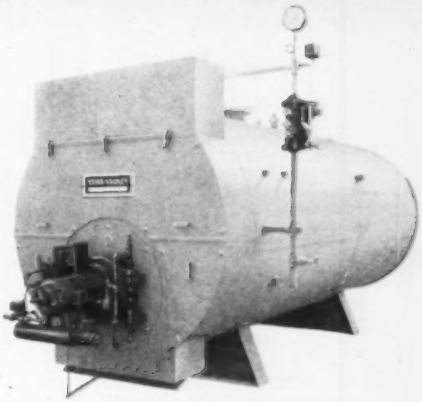
STRIKE BACK!

Give to
AMERICAN CANCER SOCIETY

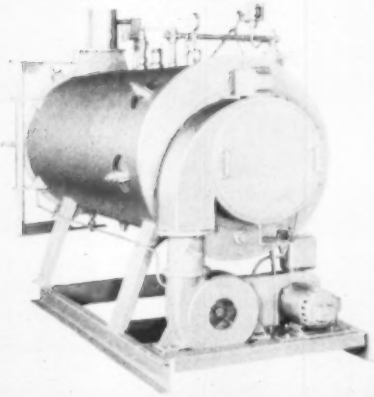
only YORK-POWER has all 4



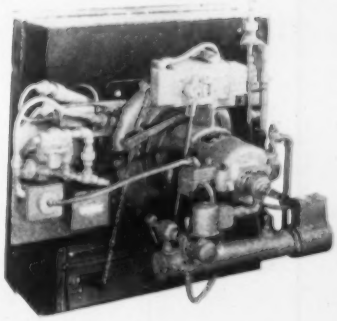
STEAM-PAK Packaged Steam Generators — 30 to 500 Horsepower High or Low Pressure Oil and/or Gas Fired



BOILER-BURNER Units Scotch Marine (illustrated) or Firebox Types for Heating Oil and/or Gas Fired



STEAM-PAKETTE Packaged Steam Generators — 15 to 30 Horsepower High or Low Pressure Oil and/or Gas Fired



F/C INDUSTRIAL Fuel Burning Systems — including Oil and/or Gas Burners (45 to 400 Hp.), Control Panels, Windboxes, Fuel Oil Heaters, Accessories

for every steam generating or heating job specify YORK-POWER—1 of 4 will do the job

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Detailed Specifications Data on York-Power Equipment will be furnished on request. Dealership Openings Available in certain key markets.

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YORK-SHIPLEY, INC., York .Pa.

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☐ Steam-Pak Generators; ☐ Steam-Pakette Generators;
☐ Boiler-Burner Units; ☐ F/C Fuel Burning Systems

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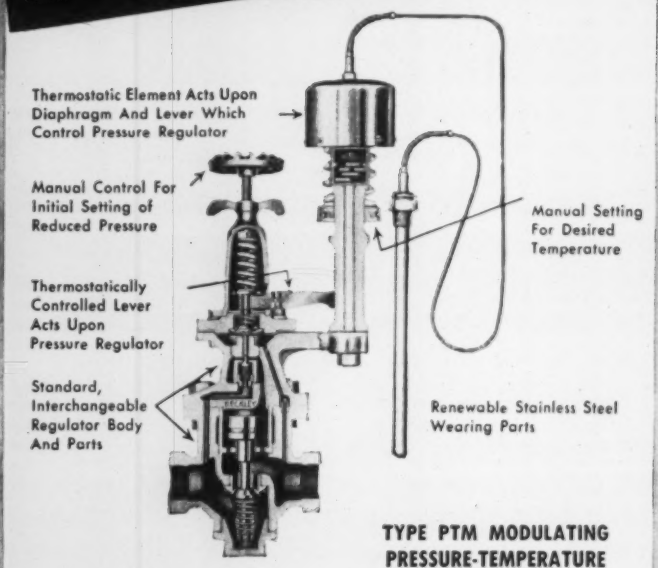
☐ We are interested in becoming a York-Power dealer. Please send additional details.

THIS NEW KECKLEY REGULATING VALVE GIVES

Finer Temperature Control

THAN EVER BEFORE POSSIBLE!


Thermostatic Element Acts Upon Diaphragm And Lever Which Control Pressure Regulator
Manual Control For Initial Setting of Reduced Pressure
Thermostatically Controlled Lever Acts Upon Pressure Regulator
Standard, Interchangeable Regulator Body And Parts
Manual Setting For Desired Temperature
Renewable Stainless Steel Wearing Parts

TYPE PTM MODULATING PRESSURE-TEMPERATURE REGULATOR

Costs No More Than Less Sensitive Separate Units

The new Keckley Type PTM modulating pressure-temperature regulator establishes a new standard of accuracy of temperature regulation for batch processing, air ducts and other exacting control jobs. As temperature tends to vary, the thermostatic control unit acts upon the pressure regulator to reduce or increase steam pressure. Pressure will modulate smoothly and rapidly between the initial setting and zero, thereby preventing overrun. Rate of pressure modulation is adjustable, giving the user a wide choice of control.

This new valve costs no more than separate Pressure and Temperature Regulators but gives much finer control and a simpler installation. Originally developed to meet exacting TVA specifications, Type PTM is a refinement upon earlier Keckley types, which are still catalogued for average requirements.

Ask for your copy of the new Catalog 55-F describing the complete Keckley line of Steam and Liquid Control Equipment.

O. C. KECKLEY COMPANY

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Pressure Regulators • Temperature Regulators • Float Valves
Diaphragm Valves • Safety and Relief Valves • Solenoid Valves

RECENT TRADE LITERATURE...

▸ *AIR CONDITIONERS*—New 2 page bulletin describes self contained air conditioners in five sizes with 3 to 15 ton capacities for commercial installations. Discusses construction, operation, maintenance. American Blower Corp., Detroit 32.

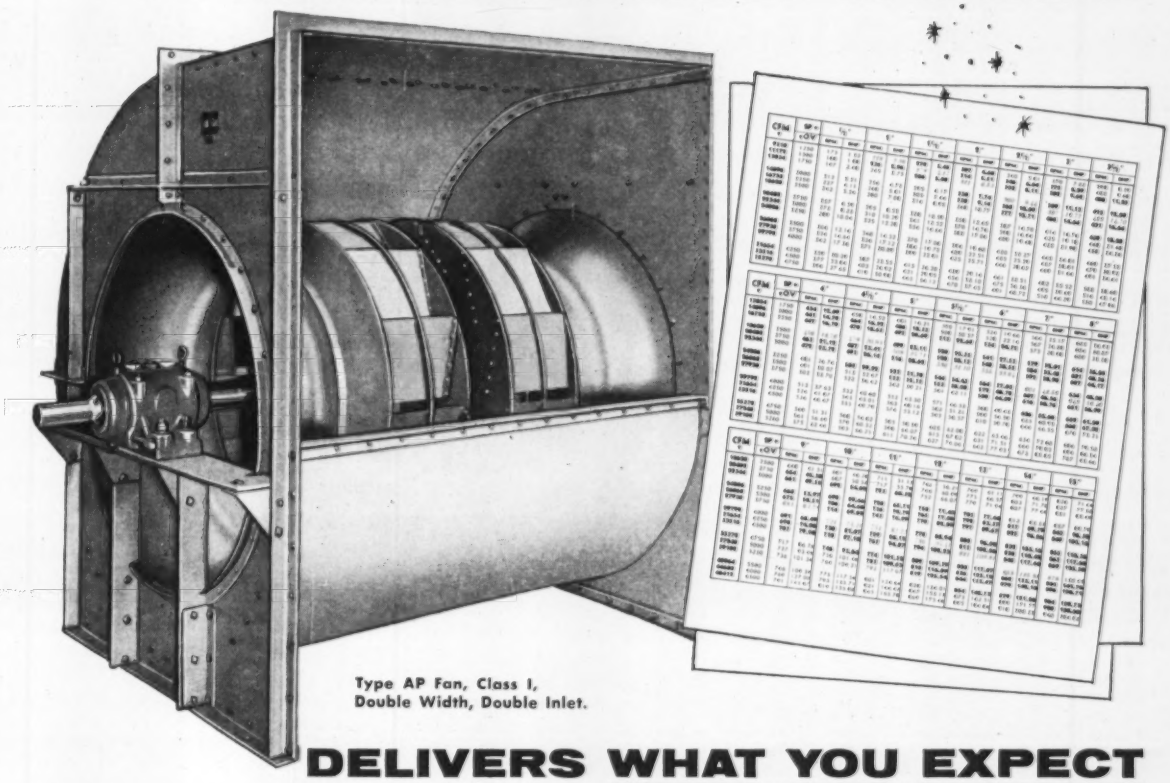
▸ *AIR CONDITIONING*—Analysis form tells how soon a commercial installation of air conditioning will pay for itself. Tables show: figures on approximate extra profits users will realize from air conditioning their business places, average number of working days requiring cooling for representative cities. Servel, Inc., Evansville 20, Ind.

▸ *AIR CONDITIONING*—Company's publication, *The Humidity Engineer*, has articles in its current number on how air conditioning aids manufacture of compressor assemblies, factors involved in air conditioning hospitals and industrial research laboratories. Kathabar Div. of Surface Combustion Corp., Toledo 1.

▸ *AIR CONDITIONING, REFRIGERATION EQUIPMENT*—New 4 page bulletin No. 4001 describes, illustrates company's line of special and standard air conditioning and refrigeration equipment. Includes photographs, piping diagrams. Patterson-Kelley Co., Inc., 10 Lackawanna Ave., East Stroudsburg, Pa.

▸ *AIR POLLUTION CONTROL*—Air pollution and its control through application of activated carbon discussed in technical bulletin E-21. Lists, describes types of atmospheric contaminants, 10 types of treatment to eliminate or reduce contaminants in industrial exhaust gases. Barnebey-Cheyney Co., Cassady at E. Eighth Ave., Columbus, Ohio.

The Product BEHIND the PERFORMANCE TABLES



Type AP Fan, Class I,
Double Width, Double Inlet.

DELIVERS WHAT YOU EXPECT WHEN YOU SPECIFY AND USE Bayley FANS

AND HERE'S WHY:

1. **WIDE EXPERIENCE** supplies a *sound basis* for both standard and custom designed Fan applications.
2. **AIR ENGINEERING** — creates *correct design* for smoothest performance.
3. **PRECISION COMPONENTS** — insure maximum realized efficiency.
4. **PRODUCTION SKILL** — achieves the end result you seek . . . *PEAK PERFORMANCE!*

WRITE for your copy of Bayley Bulletin 42-AP

Bayley BLOWER COMPANY

6600 W. Burnham Street • Milwaukee 14, Wisconsin

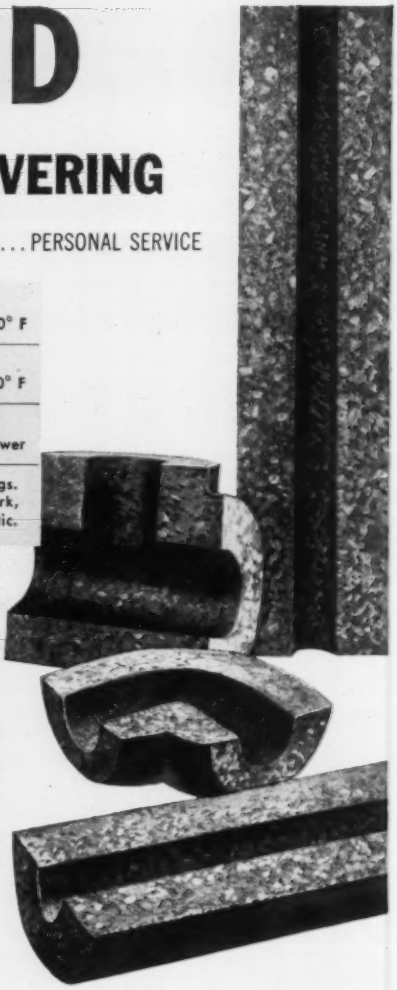
UNITED

CORK PIPE COVERING

LARGER STOCKS . . . FASTER DELIVERY . . . PERSONAL SERVICE

Light Duty Thickness (Ice Water)	to 30° F
Medium Duty Thickness (Brine and Ammonia)	to 0° F
Heavy Duty Thickness (Heavy Brine)	to —25° F or lower

For all standard pipe sizes and fittings. Molded of compressed pure granulated cork, finished with moisture-proof mineral mastic.



United Cork Companies have expanded their facilities to include the production of cork pipe covering. Increased quantities of most frequently used sizes are now available at key points coast to coast . . . in either distributor or branch warehouse stocks . . . thus insuring fast delivery of your installation requirements.

CORK. . . STILL UNSURPASSED AS A COLD LINE INSULATOR

- Extremely low thermal conductivity
- Saves at least 80% of refrigeration lost from bare piping
- Easily economically applied
- Permanent and durable, lowest long-term cost
- Does not support combustion
- Neat, sanitary, vermin-proof
- Has no capillarity

YOUR INQUIRY will bring you specifications, helpful installation data, descriptive material on United's cork pipe covering . . . and patented BB (block-baked) 100% Corkboard specially processed for low temperature work. No obligation.

UNITED BB CORKBOARD

SEE OUR CATALOG IN SWEET'S

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Manufacturers of cork insulation for almost a half century

Engineering offices, or approved distributors, in key cities — coast to coast.

RECENT TRADE LITERATURE

Continued

▸ *AIR RECOVERY SYSTEM*—Article *Protection from Smog* recommends a well engineered air distribution system, adequate removal of coarse particles and fine aerosol mists, activated carbon filtration to eliminate gaseous and vaprous impurities from intake air. Connor Engineering Corp., Danbury, Conn.

▸ *ATOMIZING DEAERATOR*—Publication 4635 describes requirements, principles of deaeration by atomization. Illustrations show company's atomizing deaerator in various installations. Cochrane Corp., Philadelphia.

▸ *BEARING DESIGN*—Features of prelubricated bearing design used on company's a-c and d-c motors given in bulletin A-2406. Design has metering plate engineered to regulate grease flow to bearing, provide pressure relief against overgreasing. Reliance Electric & Engineering Co., 1088 Ivanhoe Rd., Cleveland 10.

▸ *BLOWERS*—Catalog sheets, other literature cover company's new portable electric blower line for heating trade. Blower has 4 ft nozzle attachment for air punching boiler tubes. Pullman Vacuum Cleaner Corp., 33 Allerton St., Boston 19.

▸ *BOILER CONTROLS*—Basic safety controls for hot water space heating boilers discussed in new 8 page bulletin No. P-30. Traces one typical boiler through varying operating conditions it can encounter. McDonnell & Miller, Inc., 3500 N. Spaulding Ave., Chicago 18.

▸ *BRAZING*—Uses of "Sil-Fos" low temperature silver brazing alloy in making air conditioners, heat exchangers, copper tanks, rotors for subfractional motors presented in new 4 page folder. Handy & Harman, 82 Fulton St., New York 38.

when it comes to air conditioning...

...don't play "Blind Man's Buff"

Compare
QUALITY...
and you'll choose
MARLO
cooling
towers

1. Accurately balanced, double-width—double-air inlet, forward curved, hot galvanized centrifugal wheels and No. 16 gauge volute scrolls, mastic coated for extra corrosion resistance.
2. Quiet operating, self-aligning, oil storing graphite bearings of the sleeve-flange mounted type.
3. Full ball bearing, centrifugal type pumps of highest efficiency.
4. Specially designed wetted deck surface that assures maximum heat transfer (water to air).
5. Louver type air inlet grilles with mesh screen—easily removed for access to sump tank, suction screen, float valve or overflow.
6. Cleanable, 2-piece brass, swirl-type spray nozzles for low pressure operation.
7. Marlo "Lektro-Tektor" for protection against electrolytic sump tank corrosion.
8. Motors mounted on pivoted base for easy adjustment of belt tension.

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MARLO coil co.

SAINT LOUIS 10, MISSOURI

Quality Air Conditioning and Heat Transfer Equipment Since 1925

Wherever You Find

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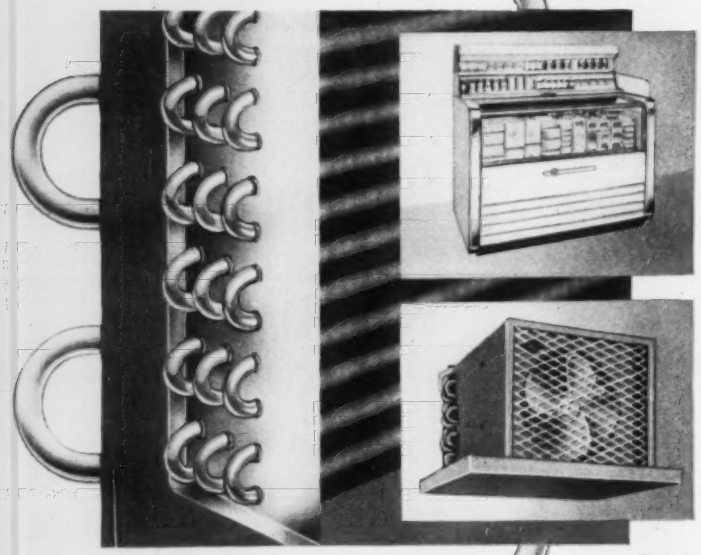


Typical Refrigeration Evaporator Applications

You Find *Confidence* in Performance!

In refrigeration or whatever the job is you have for copper tubing, you can depend on the precision quality of United Mill products. The difference is production control and processing.

Compare United quality and prompt deliveries. You get quality plus . . . including close tolerances, uniform temper and good clean outside and inside surfaces.

It costs no more to get the best copper tubing.

UNITED WIRE & SUPPLY CORPORATION
Providence 7, R. I. • Offices in Principal Cities

UNITED COPPER TUBING
"first in quality"

Permanently United

RECENT TRADE LITERATURE

Continued

▸ *CHEMICAL SEALANTS*—Reference guide and chart explains uses of special chemical sealants in industrial operations. Describes proper sealants for refrigeration, heating, piping, tanks, machine tooling equipment, oxygen assemblies, etc. Permatex Co., Inc., P.O. Box 1, Brooklyn 35.

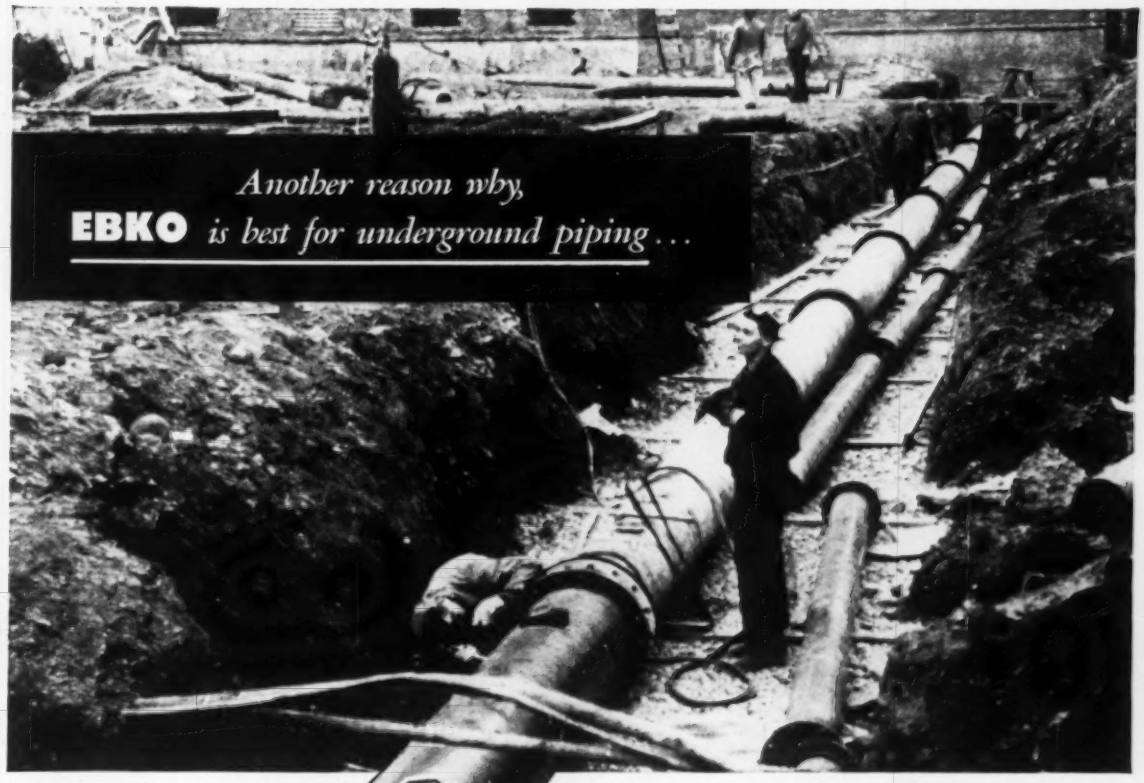
▸ *CONDENSATION RETURN*—Bulletin No. 4958A lists features, illustrates, contains size and capacity data on company's "Hotshot" condensation return units in models for pressures to 20 lb and 20 to 50 lb. The Deming Co., Salem, Ohio.

▸ *CONTROLS*—Hydraulic, temperature, process, combustion controls described in new 4 page bulletin. Contains photographs of 27 items in company's line of automatic valves, regulators, controllers, hydraulic valves, etc. A. W. Cash Co., P.O. Box 551, Decatur, Ill.

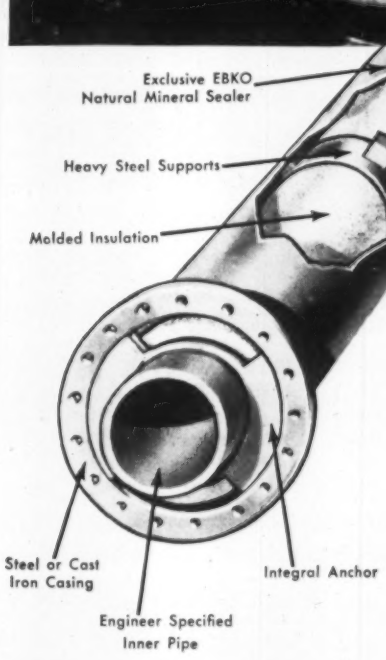
▸ *CONTROLS*—Bulletin 1130 on program control of process variables describes methods, advantages of using automatic, time-conditions control for industrial processes, tests. Contains selection charts for choosing right instruments for specific control applications. Minneapolis-Honeywell Regulator Co., Industrial Div., Wayne and Windrim Aves., Philadelphia 44.

▸ *CONTROLS*—Bulletin F 5795 tells how "Capaciline" supplementary control device "anticipates" fuel needs of controlled heating equipment, enforces straight line control on process variable. Wheelco Instruments Div., Barber-Colman Co., Rockford, Ill.

▸ *COOLING TOWERS*—"Practically every industry in which processing temperatures must be controlled uses cooling towers to dispel heat but retain water," says the Summer 1955



Another reason why,
EBKO *is best for underground piping...*



Never has an EBKO System Failed!

Over 1,000 miles of EBKO piping has gone underground since the first system was installed. The durability of this prefabricated piping system has been tested by these installations and has proven worthy of full investigation prior to the purchase of any system . . . because, never, to our knowledge, has an EBKO system failed.

What Is This Reason
For The Superior Durability
Of An EBKO System?

Simplicity . . . high quality component parts . . . improved design . . . inherent strength . . . and other factors add up to a system that is safe for any type soil. It can be completely submerged in water without deterioration for many, many years.

Each of the six component parts are held to the most rigid specifications. The simplicity of design allows EBKO to keep the quality high and yet keep the cost down.

This system costs no more initially than other prefabricated piping systems and saves money on installation and maintenance.

Complete details on this system may be had from local EBKO representatives or by writing to the factory—no obligation of course.

© 1955, E. B. Kaiser Co.

EBKO
Underground and Overhead Prefabricated Piping Systems

E. B. KAISER CO.
Since 1890
2118 West Lake Avenue • Glenview, Illinois
Phone: Glenview 4-4500

For STEAM • CONDENSATE • HIGH TEMPERATURE and CHILLED WATER • REFRIGERANTS • GASES • ETC.

"I shot an arrow into the air,
It fell to earth, I know not where."

The Arrow and the Song—Longfellow, 1845

Longfellow a space buyer?

Longfellow's lament could well have been applied to advertising back in 1845. Yes, even up to 1914 when a group of advertisers, agencies and publishers, alarmed by the waste and guesswork in their business, brought order out of advertising chaos by organizing the Audit Bureau of Circulations. These pioneers in circulation auditing established a definition for paid circulation, rules and standards for measuring circulation, methods for auditing and reporting the FACTS.

For value-minded advertisers the era of blind space buying ended in 1914. ☆ ☆ Today's experienced space buyers use the audited information in A.B.C. reports to aid them in applying media to markets and get full value for advertising dollars. Here are some of the FACTS in A.B.C. reports that provide a sound basis for advertising investments: • How much paid circulation • How much unpaid distribution • Occupational or business breakdown of subscribers • Where they are located • How much subscribers pay • Whether or not premiums are used • How many subscribers in arrears • What percentage of subscribers renew. ☆ ☆ Sales messages go direct to their targets, there's no shooting "into the air" when space buyers base their decisions on A.B.C. FACTS. This publication is a member of the Audit Bureau of Circulations because we want our advertisers to know what they get for their money when they use space in these pages. Ask for a copy of our A.B.C. report and then study it.

SEND THE RIGHT MESSAGE TO THE RIGHT PEOPLE

Paid subscriptions and renewals, as defined by A.B.C. standards, indicate an audience that has responded to a publication's editorial appeal. With the interests of readers thus identified, it becomes possible to reach specialized groups effectively with specialized advertising appeals.

A.B.C. REPORTS—FACTS AS A BASIC MEASURE OF ADVERTISING VALUE

RECENT TRADE LITERATURE

Continued

issue of *Redwood News*. Publication illustrates role redwood plays in meeting durability, workability requirements for construction. California Redwood Assn., 576 Sacramento St., San Francisco 11.

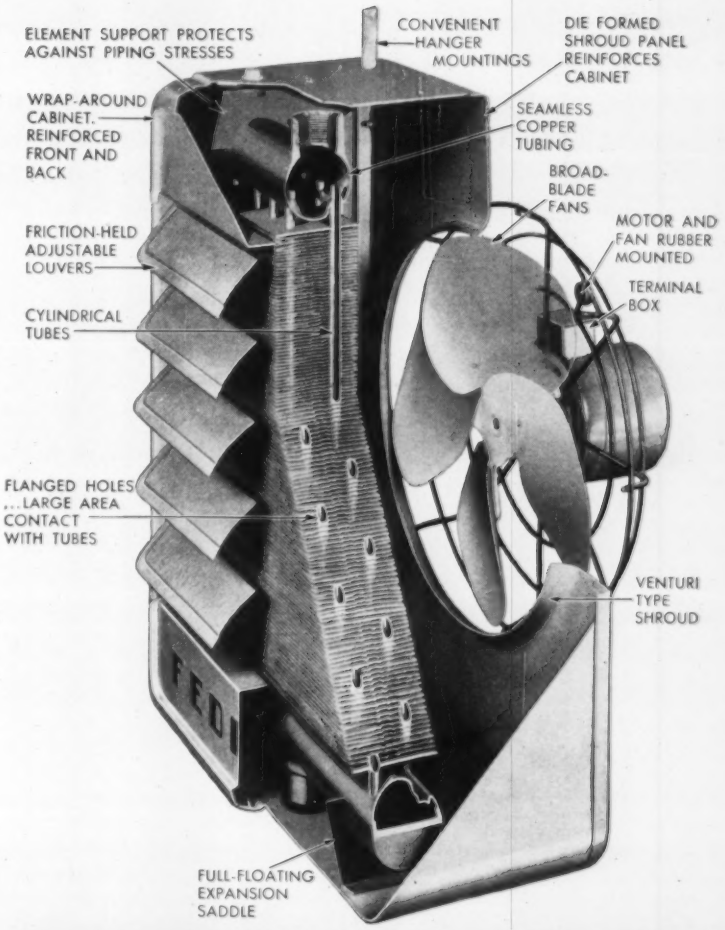
▸ *CORROSION CONTROL—How Zinc Controls Corrosion* is 32 page illustrated booklet describing how zinc lengthens life of steel products, reduces maintenance costs. Includes drawings, charts, photographs. American Zinc Institute, Inc., 60 E. 42nd St., New York 17.

▸ *CORROSION CONTROL*—Treatment of industrial equipment to control corrosion covered in new folder. Emphasizes balance between corrosion loss, treatment cost to derive lowest total expense. Hall Laboratories, Inc., 323 Fourth Ave., Pittsburgh 30.

▸ *COUPLINGS*—Bulletin No. 230 describes quick connect, quick disconnect "Hi-Flow" coupling, its uses and construction. Includes cutaway drawing. Lists dimensions of parts. Gives ordering information for spare parts, complete couplings. Snap-Tite, Inc., Union City, Pa.

▸ *CURRENT CONTROLLER*—New 4 page booklet describes company's model "EB" current controller. Lists operating features. Illustrates typical examples of unit's wide application range. Conoflow Corp., 2100 Arch St., Philadelphia 3.

▸ *DRY FLUID DRIVE*—New 12 page bulletin A-640 contains illustrations, cross-sectional drawings of "Flexidyne" dry fluid drive. Shows two methods of selection with easy to use charts. Has section on v belts for all sizes. Dodge Mfg. Corp., Mishawaka, Ind.



. . . . and in Unit Heaters

FEDDERS makes EXTRA QUALITY competitive!

● Thousands of installations and twenty years of service have written the *user-satisfaction* story of Fedders Unit Heaters. And Fedders talent, skill and volume manufacturing brings you Fedders performance at competitive prices.

Three complete lines of Fedders Horizontal, Downblow and Gas-fired Unit Heaters give you the most economical sizes for every job. Write for latest catalogs and prices.

FEDDERS-QUIGAN Corporation

HEATING DIVISION **TRENTON 7, N. J.**

This extremely flexible air conditioning duct will save you as much as 32%

- eliminates elbows, clamps and special fittings — saves material
- proved flameproof and waterproof by rigid tests — for long life
- saves up to ⅔ installation time — which saves your money
- broad temperature range — 0° to 250° F. — for broad use

Thermaflex will cut your installation costs substantially when you use this rugged, light-weight duct to connect main line ducts with diffusers, sound boxes and other types of distributors in any air-conditioning system — high or low pressure.

Because Thermaflex is so *flexible*, it easily compensates for misalignment between main line and outlets. It's easy to work with in tight quarters, too — snakes around obstructions and provides a direct, air-tight connection without costly elbows and complicated rigid ducting.

Thermaflex is a snap to install — you can cut it with a knife and side cutters. Brush it with adhesive and slide it over the metal connecting outlet. This is all that's required for a positive, air-tight joint.

Available in 12-foot lengths, 2″ to 12″ diameter. Write today for Bulletin 12C1. It shows you how to do a better installation job and cut your costs at the same time.

Visit us at the Exposition of Air Conditioning and Refrigeration Industry — Atlantic City, November 28 — December 1. Booth No. 216.

Flexible Tubing

CORPORATION
GUILFORD, CONNECTICUT
LOS ANGELES 64, CALIFORNIA

RECENT TRADE LITERATURE

Continued

▸ *DUCT*—New 6 page folder on "Silent Duct" for making flexible connectors, lists advantages, method of fabrication, specifications. Emphasizes time, money savings with use. Also introduces company's bender, designed to form connectors, duct hangers. Elgen Mfg. Corp., 41-34 39th St., Long Island City 4, N.Y.

▸ *DUST COLLECTION*—New 12 page bulletin offers specifications, descriptive details on company's "Hydro-Filter" dust collector. Covers filtering principle of unit. National Dust Collector Corp., Machinery Hall Bldg., Chicago.

▸ *DUST CONTROL*—Basic problems of moderate loadings of dry granular particles, medium concentrations of fine particles, heavy duty loading of all sizes, high concentrations of dry granular particles in large volumes, extremely fine particles and material that should be reclaimed dry, discussed in new bulletin. Solutions given for each problem. American Air Filter Co., Inc., 215 Central Ave., Louisville 8.

▸ *ELECTRONIC PROCESS CONTROL*—Pamphlet lists benefits of electronic process control. Discusses briefly company's transmitter, recording set station, controller, manual control station, electropneumatic valve positioner. Manning, Maxwell & Moore, Inc., Stratford, Conn.

▸ *EVAPORATIVE CONDENSERS*—Manual on "Perma-Fan" evaporative condensers in 5 to 110 ton size range contains installation, maintenance instructions for full line. Diagrams illustrate dismantling, reassembly process. Check list provided for installing contractor. Drayer-Hanson, Inc., 3301 Medford St., Los Angeles 63.

DOUBLE MECHANICAL SHAFT SEALS

PERMANENTLY LUBRICATED BALL BEARINGS

These two advanced features of

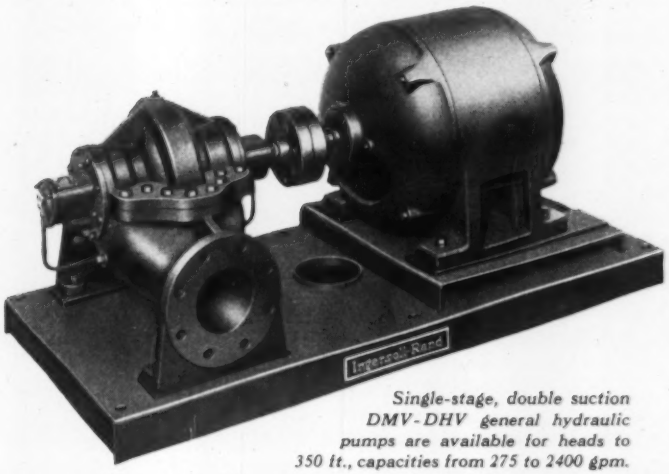
DMV-DHV PUMPS

end pump maintenance problems

Used in place of conventional packed stuffing boxes, Double Shaft Seals eliminate the need for periodic inspections and repackings. Performance-proved and self-adjusting, they require no attention throughout their entire service life.

Sealed, Cartridge-Type Ball Bearings do away with the necessity of greasing or oiling pump bearings. Here, in the DMV-DHV pump, the bearing lubricant is permanently sealed in—and assures years of successful operation.

You can install this modern I-R pump anywhere due to the greater compactness obtained with this modern construction. It is the simplest, most maintenance-free pump ever built by Ingersoll-Rand for general hydraulic service. Write for Bulletin 7248-A, or see your nearest I-R branch office.



Single-stage, double suction DMV-DHV general hydraulic pumps are available for heads to 350 ft., capacities from 275 to 2400 gpm.

Ingersoll-Rand

10-288 Cameron Pump Division
11 Broadway, New York 4, N. Y.

PUMPS • CONDENSERS • TURBO-BLOWERS • COMPRESSORS • ROCK DRILLS
DIESEL & GAS ENGINES • AIR & ELECTRIC TOOLS

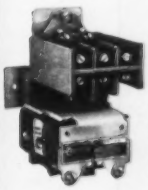
FURNAS ELECTRIC CONTROLS

do the best job for AIR CONDITIONING

Objectionable voltage drops eliminated by using a Furnas Electric Increment Starter for Part Winding motor applications. Compare—no expensive auto transformers, no resistors, small size. Increment starting incorporates the advantages of other types of step starting at the lowest cost in the smallest space. Pick the size you need. In-between sizes—a 10, 20*, 30, 40* and 60 hp. size 220 volts.

*Major savings with in-between sizes.

SPECIAL STARTERS AND CONTACTORS



Designed for low cost control of hermetic motors. Two sizes — 20 and 30 amps • Dual voltage starter coils • Interchangeable parts • Super Quick Trip Thermal Overload units.

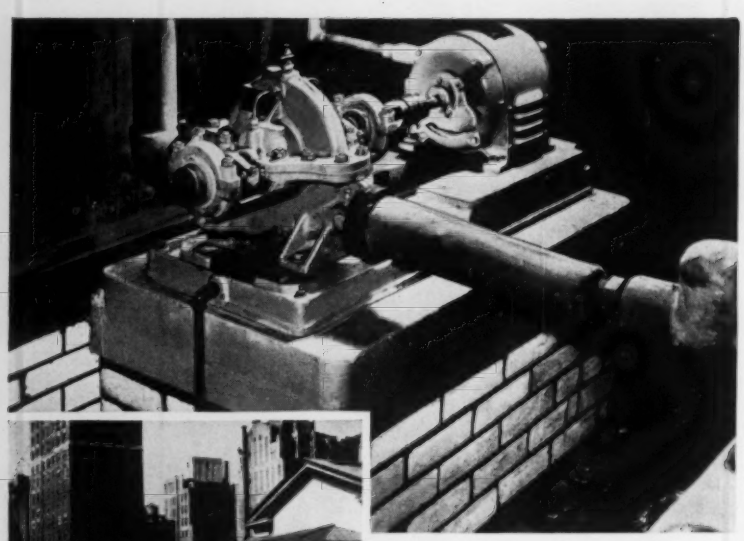
Write for Bulletin 25410 for complete air conditioning control information. Furnas Electric Company, 1041 McKee Street, Batavia, Illinois.

FURNAS

FURNAS ELECTRIC COMPANY

BATAVIA ILLINOIS

Sales Representatives in all Principal Cities



Above view shows a Deming Fig. 5010 double suction centrifugal pump in booster service at the New York Public Library. Quiet operation of the Deming pump was an important consideration in its selection.

The impressive New York Library is visited by thousands daily. Its location at Fifth Avenue and 42nd Street is one of the busiest corners in the world.

Pump Keeps Library Users "Thirsty for Knowledge"

People thirsty for water are less "thirsty for knowledge." Thousands of daily visitors at the big New York Public Library take it for granted that cool drinking water is always available. A small Deming double suction centrifugal pump assures that service.

When city water pressure drops below the required pressure, the Deming Pump goes into action. It circulates 50 gallons of cool water per minute and operates from early morning to late at night, when needed.

Dependability and quiet operation are two important advantages of this Deming Pump, according to the Chief Engineer of the world-famous institution.

Rotating elements of the Deming Series 5010 Centrifugal Pump are in perfect static and dynamic balance to insure smooth, quiet operation at all speeds. Made in sizes from 1½ to 10 inches, these pumps are available in a wide range of capacities from 25 to 4000 gallons per minute.

Wide use of these pumps in institutional, industrial and commercial services suggests that you, too, may have good reason to investigate their proved advantages. Complete data on Deming Series 5010 Double Suction Centrifugal Pumps will be sent promptly upon request.

The DEMING Company

560 BROADWAY • SALEM, OHIO

75th ANNIVERSARY DEMING PUMPS 1880 • 1955

RECENT TRADE LITERATURE

Continued

▸ *FILTER DRIERS*—New 6 page bulletin discusses construction features of "Trap-Dri" filter driers. Analyzes causes of difficulty in refrigerating systems. Tells how drier combats moisture, acids, dirt. Contains comparative data, charts, specifications on 20 different sizes. A-P Controls Corp., 2450 N. 32nd St., Milwaukee 45.

▸ *FILTRATION*—Reprint T-133, *Modern Filtration Practices*, compares diatomite and sand filtration practices. Discusses advantages, disadvantages of both for swimming pool purification. Graver Water Conditioning Co., 216 W. 14th St., New York 11.

▸ *FINNED TUBE RADIATION*—Bulletin No. 1650 describes "Sarcofin" finned tube radiation, includes IBR ratings. "Sarc-fin" baseboard radiation featured in bulletin No. 1625. Sarco Co., Inc., Empire State Bldg., New York 1.

▸ *FOAM INSULATION*—Technical bulletin on "Isothane" polyurethane foam for thermal insulation and sound control lists properties, application methods. Surface Chemicals, Inc., 1101 Thompson Ave., McKees Rocks, Pa.

▸ *HEATING CATALOG*—New 168 page catalog for 1955-56 lists company's stock of tools, equipment, parts, supplies, accessories for heating trade. Also contains items for air conditioning. A. R. Webber Co., Inc., New Haven, Conn.

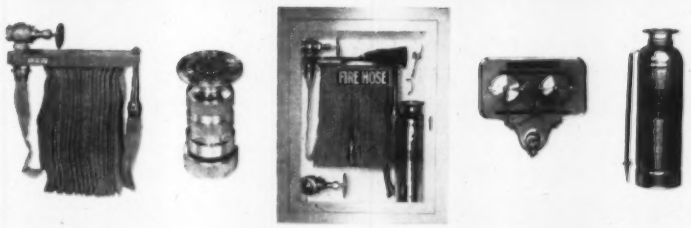
▸ *HOSE, JOINTS*—New 8 page catalog No. 149 covers company's "Flexon" lines of flexible metal hose, expansion joints. Gives new specifications for expansion joints. Flexonics Corp., Maywood, Ill.

engineers and contractors agree...

it pays to figure on

ALLENCO

INTERIOR FIRE-PROTECTION



If you've been figuring with Allenco right along, you may be surprised that some people *don't*.

If you haven't been using Allenco lately, you *will* be surprised at what you've been missing.

√ figure next job with ALLENCO

Established 1887

W. D. ALLEN MANUFACTURING CO.

709 Allenco Bldg. 566 West Lake Street Chicago 6

25 Sales Offices • New York 7

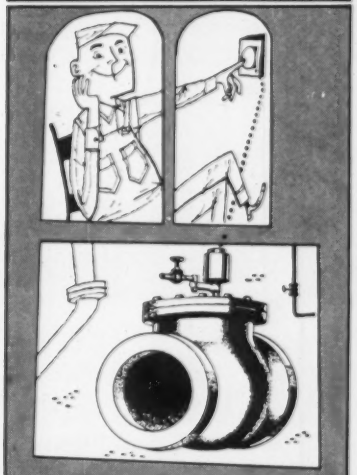
modernize

YOUR PLANT WITH

G-A SOLENOID VALVES

WHICH CAN BE OPERATED

LIKE THIS



√ or by many other types of electrical impulse

√ Use the angle body and save the price of an elbow fitting

√ Positive Control

√ Sizes ½" thru 36"

√ Used on Water, Oil, Air and Many Other Liquids

BULLETIN W-7 HAS THE TECHNICAL FACTS

WRITE FOR IT TODAY

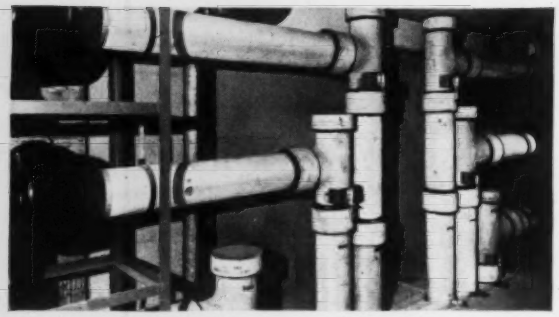
GOLDEN ANDERSON

Valve Specialty Company

1210 RIDGE AVE., PITTSBURGH 33, PA.

Designers and Manufacturers of VALVES FOR AUTOMATION

Indoors...



or outdoors...

TRANSITE INDUSTRIAL VENT **PIPE**

gives long, trouble-free service

If you need a vent with high corrosion resistance for indoor service, or one that will withstand the deteriorating effect of severe weather conditions, you can rely on Transite® Industrial Vent Pipe to do the job.

Made of two of nature's most indestructible minerals, asbestos and cement, Transite is highly resistant to the corrosive fumes, vapors and dusts that must so frequently be removed from research laboratories and industrial buildings.

Transite has a long record for standing up in all types of weather. It never needs painting or other preservative coatings. It will provide long, trouble-free service without maintenance.

Transite Industrial Vent Pipe offers other advantages, too. It is easy to install because it is light in weight and can be handled readily. No special equipment is needed for cutting on the job. A wide variety of fittings and pipe sizes make it adaptable to every industrial venting service.

For additional information about the use of Transite Industrial Vent Pipe for your venting problems, write to Johns-Manville, Box 60, New York 16, New York.

Johns-Manville

TRANSITE INDUSTRIAL VENT **PIPE**

AN ASBESTOS-CEMENT PRODUCT

RECENT TRADE LITERATURE

Continued

▸ *INSULATION*—Data sheet 2D2-6 is guide to basic measurements of insulating value. Illustrates role redwood plays in combining effective insulation with durability, natural beauty. California Redwood Assn., 576 Sacramento St., San Francisco 11.

▸ *INSULATION*—Data book is compilation of company's literature on thermal barriers for applications from −200 to 1900 F, applicable products and their properties. One bulletin discusses "custom-molded" 85 percent magnesia, thickness standards, packing information. Also discusses segmental pipe covering and cement. Other bulletins feature "Tri-Calite" and "Dri-Mag" insulations; "Jointite" corkboard and cork pipe covering for low temperatures; low pressure steam, hot and cold water, and antisweat insulations. Price list for cork pipe covering included. Mundet Cork Corp., 7101 Tonnelle Ave., North Bergen, N.J.

▸ *INSULATION*—New 4 page folder describes "Duraface Foamglas" designed to combine insulation, integral finish in single block. Covers manufacturing process by which hard white crust is fused to block, lists physical properties, details sizes available. Pittsburgh Corning Corp., 1 Gateway Center, Pittsburgh 22.

▸ *LUBRICATION*—Lubrication of air conditioning machinery is topic of recent number of manufacturer's periodical. Covers commercial, residential air conditioning; industrial air conditionng. The Texas Co., 135 E. 42nd St., New York 17.

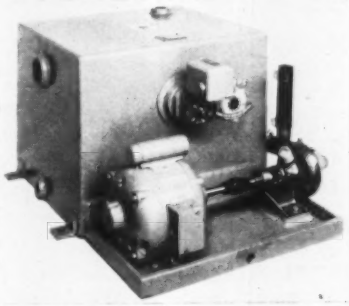
▸ *MACHINERY MOUNTINGS*—Data on stopping vibration, shock, noise transmission by using company's steel spring machinery mountings contained in bulletin K3A. Describes "Series L Vibro-Isolators." Korfund Co., Inc., 48-01F 32nd Pl., Long Island City 1, N.Y.

▸ *MAKE-UP WATER TREATMENT*—Technical reprint T-137, *Treatment of Make-up Water with Automatic Mixed-Bed Demineralizer*, discusses specific utility installation at which such demineralizer is installed. Details factors leading to choice of this equipment, the system itself, problems met in starting up plant. Graver Water Conditioning Co., 216 W. 14th St., New York.

▸ *NOZZLE*—Venturi insert nozzle designed for metering liquid, steam, air, gas discussed in 4 page bulletin No. 130-K3A. Lists advantages, contains capacity tables, covers operating, and design features. Builders-Providence, Inc., 345 Harris Ave., Providence, R.I.

▸ *PARTS, SUPPLIES*—New 160 page catalog covers refrigeration, heating parts, supplies handled by whole-

YOUR BEST BUY IN CONDENSATE PUMPS



Is The

EAGAN EAGLE

This high quality unit offers you these outstanding advantages: *low initial cost; far more capacity than any other similar pump at the same price* (to 8000 sq. ft. EDR at 20 psi); *a low return inlet* (to eliminate need for a pit even though return lines are as low as a foot above the floor); *all bronze centrifugal pump* with a nonclogging open impeller, stainless steel shaft; *flexible connectors and coupling* (to isolate the pump, eliminate pipe cramp, wear and noise); *thermal overload protection; a level indicating float switch.*

These advantages — and many more — are yours for the asking with the Eagan Eagle. (other models available with capacities to 100,000 sq. ft. at 200 psi.)

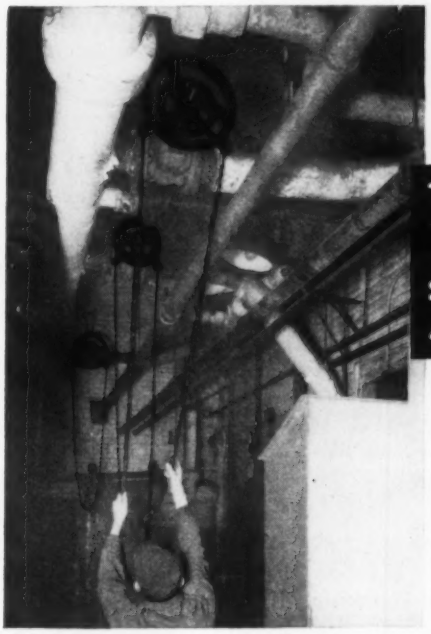
Write for Bulletin and prices.

WALTER H. EAGAN CO., INC.

Mfrs. of condensate, vacuum, turbine, boiler feed, centrifugal, proportioning and fuel oil pump and heater sets.

Pump Specialists Since 1920

2337 Wallace Street **Philadelphia 30, Pa.**



Every Valve Easily Accessible with

Babbitt

—Adjustable—

SPROCKET RIM

with Chain Guide

NEWLY REDESIGNED for greater strength—easier, quicker, more solid assembly.

- **Simplifies pipe layouts**
- **Fits any size valve wheel**
- **Prevents accidents**

Your supplier carries complete stocks. Call him — or write for details and prices.

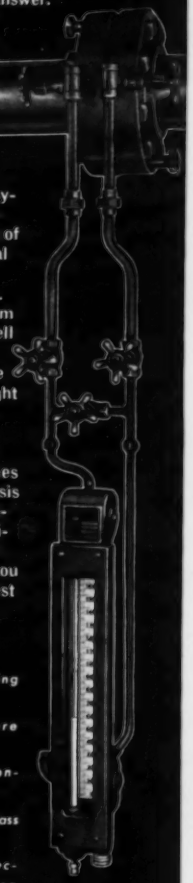
Babbitt STEAM SPECIALTY CO.

8 BABBITT SQUARE, NEW BEDFORD, MASSACHUSETTS, U. S. A.

UNMATCHED ACCURACY

in direct flow indication

Wherever you seek simplicity and high accuracy in flow measurement at lowest cost, the Meriam "H" Meter is the well-known answer.



Here is an easy-to-install flowmeter . . . free of all conventional service requirements . . . giving long-term economy as well as low initial cost. There are no pressure tight bearings . . . no magnetic followers . . . no stuffing boxes . . . no hysteresis problems whatsoever. No calibration is ever required, yet you have the highest accuracy available.

- ★ *High operating pressures*
- ★ *High pressure differentials*
- ★ *All steel construction*
- ★ *Heavy duty glass enclosure*
- ★ *Built-in protection against line surges*

Write for Bulletin 18A

Meriam Manometer Instrumentation

...for pressures, vacuums, flows, liquid levels.

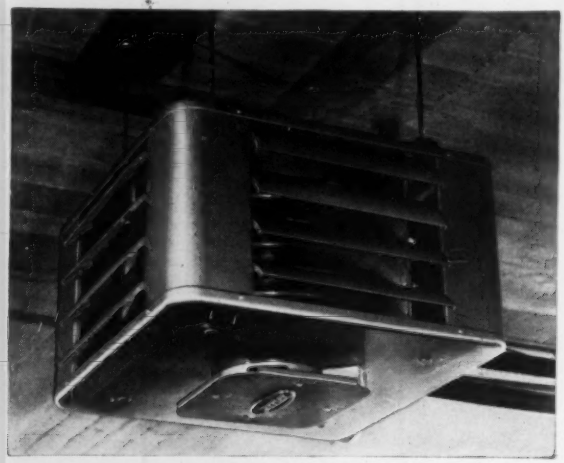
meriam

INSTRUMENT COMPANY

10920 Madison Ave. • Cleveland 2, Ohio

Carrier knows heating

Carrier has fifty years of experience in "making" and controlling temperatures. Today Carrier offers a choice of steam and hot water unit heaters in various types and a wide range of sizes. All are of highly advanced design for the efficient distribution of heat in factories, warehouses, display rooms and the like.



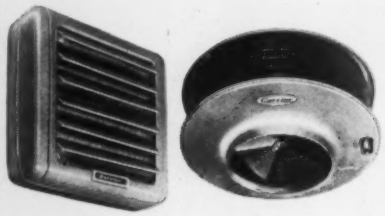
The Carrier 4-way Directed-flo Unit Heater

is the answer to the problem of heating large spaces. In contrast to conventional types of unit heaters, the directional-flo unit will heat three times the same area more economically and at a lower initial cost. Fewer heating elements are required. Less piping, valves and fittings are needed. The 4-way delivers quick heat downward from any or all four sides . . . as much or as little as wanted. Eight sizes—82,000 to 590,000 Btu/hr.

WRITE or USE COUPON for complete information

CARRIER Horizontal Air Discharge Unit Heater is powerful, smartly styled and quiet in operation. For retail shops, restaurants, garages, offices. Sizes 21,000 to 200,000 Btu/hr.

CARRIER Projection Type Unit Heater gives very efficient down-blow heat distribution, even from high ceiling installation. Choice of standard or low temperature rise coils. 30,000 to 576,000 Btu/hr.



Carrier

AIR CONDITIONING
REFRIGERATION
INDUSTRIAL HEATING

CARRIER CORPORATION, 305 S. Geddes St., Syracuse, New York
Send folders on features and selection data of Carrier Steam and Hot Water Unit Heaters.

*Name*_____

*Business*_____

*Address*_____

RECENT TRADE LITERATURE *Continued*

saler. Contains product illustrations, engineering and application data, specifications for ordering by mail. Vincent Refrigeration & Heating Supply Co., Milwaukee.

▸ *PROPELLER FANS*—New bypass duct fan, double ring reversible fan detailed in catalog A-109A. Specifications, dimensions, performance figures on 18 other industrial ventilating fans, plus intake units, unit heaters, accessories also given. Hartzell Propeller Fan Co., Piqua, Ohio.

▸ *PROTECTIVE COATINGS*—New 19 page report on comparative properties of protective coatings contains information on 14 types of coatings widely used to protect equipment, walls, etc., where fumes, industrial atmospheres cause corrosion. Includes physical, chemical data. Atlas Mineral Products Co., Mertztown, Pa.

▸ *PURGE METER*—Bulletin No. 135 describes company's "Sho-Rate 50" for metering small flows of liquids, gases. Contains description of various models, accessories. Presents capacity charts, dimensional drawings. Brooks Rotameter Co., Lansdale, Pa.

▸ *REFRIGERATING MACHINES*—Illustrations, specifications, design data on refrigerating machines for commercial, industrial use given in 16 page bulletin No. 100-G. Shows specific installations where compressors used. Frick Co., Waynesboro, Pa.

▸ *REFRIGERATION CONTROLS*—Time controls for refrigeration applications featured in 4 page catalog No. 5544. Expressly designed for defrosting, controls are illustrated, described in concise terms. Paragon Electric Co., Two Rivers, Wis.

▸ *ROOF VENTILATORS*—Dimensions, specifications, performance data on line of roof ventilators presented in catalog A-112. Illustrates, gives information on company's new units. Hartzell Propeller Fan Co., Piqua, Ohio.

▸ *ROTARY MACHINES*—Bulletin 75-B catalogs company's line of hand and power operated rotary machines, rolls, accessories. Has illustrated selection chart showing various job operations. Niagara Machine and Tool Works, 683 Northland Ave., Buffalo 11.

▸ *SPEED CHANGERS*—Operating advantages of "Vari-Pitch" speed changers described in new bulletin 20B6013D. Includes diagrams, selection and speed

RECENT TRADE LITERATURE

Continued

range tables. Allis-Chalmers Mfg. Co., 1171 S. 70th St., Milwaukee.

▸ *STAINLESS FASTENERS*—Describing stainless fastener styles in company's stock, 8 page brochure includes data, illustrations of screws, bolts, nuts, washers, rivets, etc. Allmetal Screw Products Co., Inc., 821 Stewart Ave., Garden City, N.Y.

▸ *STAINLESS PIPING*—New 16 page stainless steel engineering data book contains design, dimensional information on flange drilling templates, flange and ring joint facings, stainless steel pipe, pipe threads, thread engagement; pressure-temperature ratings and conversion factors, resistance of fluid flow; hardness conversion tables, metal casting factors, physical and mechanical properties, etc. Cooper Alloy Corp., Hillside, N.J.

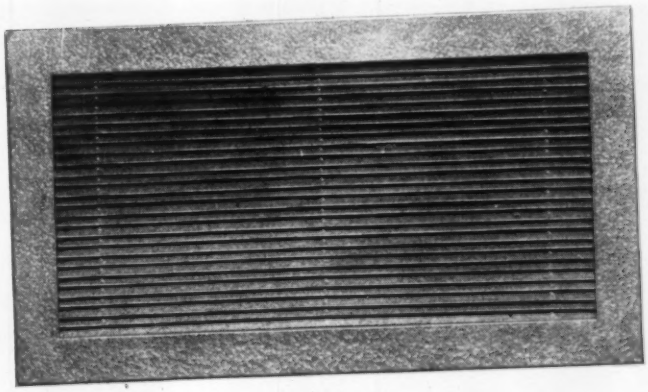
▸ *STAINLESS TUBING, PIPE*—Data folder discusses attributes of stainless steel, how it can be fabricated. Includes tables of analyses, mechanical properties, creep strength, physical properties, oxidation resistance of nine stainless tubing steels. Tubular Products Div., Babcock & Wilcox Co., Beaver Falls, Pa.

▸ *STEAM GENERATORS*—New packaged steam generators in sizes 10,000 to 46,000 lb per hr of steam presented in 16 page catalog. Gives capacities, dimensions, construction features, instrumentation, accessories, sectional drawings, installation photographs. Foster Wheeler Corp., 165 Broadway, New York 6.

▸ *STEEL PRODUCTS*—Bulletin 11-2 is buyer's guide to bars, structurals, plates, sheets, strip. Gives information on standard specifications; types, range, accuracy of cutting to user's needs. Features hot rolled carbon bar, structural, flat rolled steels. Joseph T. Ryerson & Son, Inc., Box 8000-A, Chicago 80.

▸ *TEMPERATURE INSTRUMENTS*—Filled thermal systems for indicating, recording, controlling, transmitting, compensating, programming temperatures from −400 to 1000 F are illustrated, described in 24 page catalog 12-A-10. Fischer & Porter Co., Hatboro 35, Pa.

▸ *TORQUEMETERS*—Data sheet 10.18-10 describes systems consisting of pickup units and company's "ElectroniK" instruments. Combination designed to measure torque of engines, pumps, compressors, other rotative machinery. Minneapolis-Honeywell Regulator



- CUTS INSTALLATION TIME OVER ½!
- EASY TO INSTALL *Anyone Can Do It!*
- COMPLETE—NO WOOD MOLDINGS TO ADD!

NEW! THIN CORE GRILLE FOR DOORS – PARTITIONS ¼" to ¾" THICK!

First Grille ever designed specifically for thin doors and partitions. Anyone can install it in just a few minutes time. No close tolerances required . . . almost a half-inch extra on sides for positioning. Telescoping auxiliary frame fastens to grille with posts and screws. Clamps tight. No holes to position. Practically no danger of ruining door. No wood moldings. All steel. Rattle-proof. No vision, with 80% free area. Available with or without frame, all sizes. Gray or tan prime coated, or Hammertone finish in gray or bronze.

→ ACTUAL SIZE Cross Section

WRITE FOR OUR COMPLETE FREE CATALOG

Listing Over 1000 Types and Sizes of Grilles for Every Requirement

A-J MANUFACTURING CO.

Dept. H-9 - 2119 Washington St. - Kansas City, Mo.

Two NEW industrial heaters that mean MORE CONTRACTS for you

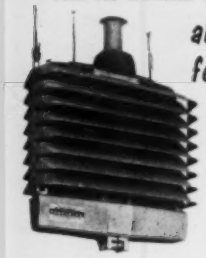
Easy to Install
Minimum Servicing
Automatic Operation

THERMOBLOC
DIRECT-FIRED HEATERS

The ideal warm air heater that heats large open buildings in all directions without ducts. Where necessary to heat individual rooms, THERMOBLOC is easily adaptable to ductwork.

THERMOBLOC is *fully* automatic and can be installed in a matter of hours. Available for either oil or gas. THERMOBLOCS are manufactured in nine models from 100,000 btu to 2,250,000 btu output. This means you can give your customers exactly what they need in heating capacity . . . fast!

Ask for Bulletin GC-4-55.



and "Bring the Sun Indoors" for your customers with...

PANELBLOC
GAS FIRED INFRA-RED
UNIT HEATERS

Heats like the sun . . . with gentle, healthful rays. Requires no fan or motor . . . no electrical connections. Installation requires only support from ceiling and hooking up to fuel supply and vent. Unit burns any commercial type gas fuel. You can guarantee customers will keep warm even when power lines are down.

Infra-red rays radiate to the spot you want to heat. PANELBLOC heats only personnel and machines or other objects . . . not air.

Heat is not deflected by draft or wasted in the ceiling. No moving parts mean less maintenance. Available in two sizes, 62,500 btu and 125,000 btu input. Ask for Bulletin P-154.

You can please your customers and make more profits for your company by specifying THERMOBLOCS or PANELBLOCS, depending on the requirements of the installation. Contact Thermobloc Sales today.

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Division of
PRAT-DANIEL CORPORATION
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Prat-Daniel Corp.
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South Norwalk, Conn.
Gentlemen:
I would like to know more about ☐ THERMOBLOCS ☐ PANELBLOCS
Name_____ Title_____
Company_____
Address_____

RECENT TRADE LITERATURE — *Continued*

Co., Industrial Div., Wayne and Windrim Aves., Philadelphia 44.

▸ *VALVE*—Features of company's two-way midget solenoid valve presented in form No. V5001. Lists new port and pipe sizes, pressure ratings, underwriters' approvals. Automatic Switch Co., 391 Lakeside Ave., Orange, N.J.

▸ *VALVES*—Installation data sheet on vapor equalizing valves for radiators, air eliminators for basement mains illustrates actual sizes of air outlets for which units are used. Shows how to install air eliminators on steam mains. Gorton Heating Corp., Cranford, N.J.

▸ *VALVE POSITIONER*—Bulletin F 5991-1 describes company's "Throttltrol" automatic valve positioner designed for use with control instruments having high and low contact in neutral position. Barber-Colman Co., Wheelco Instruments Div., Rockford, Ill.

▸ *VISCOSITY MEASUREMENT*—Company's "Viscometran" viscosity measuring device, designed for continuous process quality control, presented in new 4 page brochure. Principle of operation, advantages, installation data given. Brookfield Engineering Laboratories, Inc., 240 Cushing St., Stoughton, Mass.

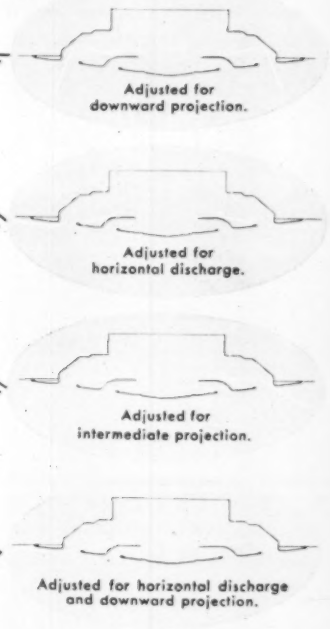
▸ *WATER CONDITIONING*—Memo B-1-F M37 discusses continuous proportioning of chemicals into boiler feed water for increased protection, corrosion-resistance, cost savings. Shows typical boiler treatment installation. Proportioneers, Inc., 345 Harris Ave., Providence, R.I.

▸ *WATER HEATERS, BOILERS*—Leatherbound looseleaf catalog covers every size water heater and heating boiler in company's line. Gives specifications, trade prices. Describes size, type of boiler for specific applications. Portmar Boiler Co., 193 Seventh St., Brooklyn 15.

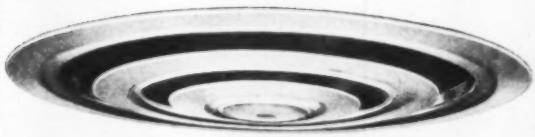
▸ *WELDING DATA*—Technical data card 178 gives stress rupture properties of chromium-nickel stainless steel weld deposits. Tubular Products Div., Babcock & Wilcox Co., Beaver Falls, Pa.

▸ *WELDING EQUIPMENT*—New 16 page catalog features equipment for "Aircomatic" inert-gas-shielded metal arc welding process. Includes information on manual, automatic units along with accessory apparatus, welding wire. Air Reduction Sales Co., 60 E. 42nd St., New York 17.

Take a look at a TRULY ADJUSTABLE Diffuser


Adjusted for downward projection.
Adjusted for horizontal discharge.
Adjusted for intermediate projection.
Adjusted for horizontal discharge and downward projection.

You Get Better Air with AGITAIR



AGITAIR®

TYPE "OA"

Here's a distinctively different diffuser with a radically new means of controlling air direction at four different angles of discharge simultaneously. *Without changing the position of the spinnings,* AGITAIR "OA" diffusers can be adjusted to put the air where you want it in one, two, three or four directions . . . *after installation.* Result: Segmentized . . . positive adjustability with Finger-Tip Air Direction Control.

Write for Bulletin C-101

Contains complete data, performance charts, construction details, etc.

AIR DEVICES INC.

185 MADISON AVENUE, NEW YORK 16, N. Y.

AIR DIFFUSERS • FILTERS • EXHAUSTERS

Only the d-h Flexazone Central-Plant Air Conditioner Gives you

24 ARRANGEMENTS!
ZONES EASILY FIELD ALTERED!
HORIZONTAL OR VERTICAL DISCHARGE!
PLUS
D-H EXCLUSIVE DAMPER ARRANGEMENT
Gives independent, variable control for as many as 7 separate zones

Flexibility—that's the *extra* you get with Flexazone! Only Flexazone can be assembled 24 different ways, depending upon available space—*in the field.* Only Flexazone allows you to add or change zones at any time—*in the field.* And only Flexazone gives you a choice of horizontal or angular air flow from the plenum. These *exclusive* features pay off in cheaper installation, greater design-freedom and lower costs—important benefits, whether you're a contractor, architect, engineer, or building owner!

Want to learn more about Flexazone? Write for bulletin C-4.22.

d-h SINCE 1910

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INCORPORATED

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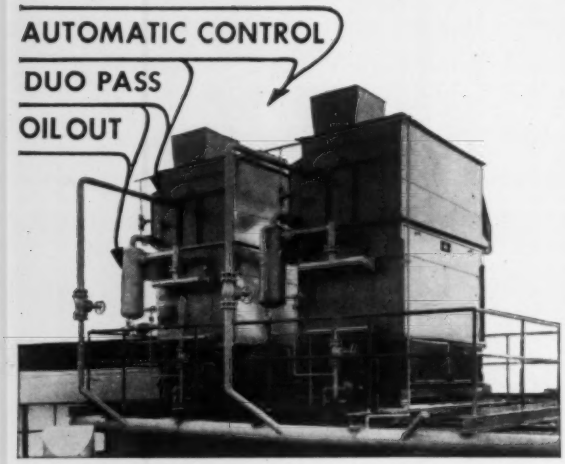
Subsidiary of National-U. S. Radiator Corp.



SAVE HALF THE ENGINEER'S TROUBLES WITH A REFRIGERATION PLANT

Hundreds of engineers have been interviewed about their experience with the Niagara Aeropass Condenser. In one way or another, they say, "I wouldn't go back to anything else." And their managers, who watch costs, say, "Best investment we ever made, couldn't operate now, without it."

Niagara Aeropass Condensers have three exclusive features which save trouble and money in running a refrigeration plant:

"The Duo-Pass"— keeps scale and salts from crusting the coils, keeps the condenser always at full capacity.

The "Oilout"— removes oil and dirt from the refrigerant, at the exact point where the oil vapor is condensed and the refrigerant is not.

The "Balanced-Wet-Bulb" control gives automatic operation at the minimum head pressure, saving power cost the year 'round!

In addition, the Niagara Aeropass Condenser saves nearly all your cost of cooling water, quickly bringing back to you the cost of installation. In plants where refrigeration is a production process, owners know that this condenser has reduced their costs.

Write for Bulletin 103; Address Dept. HP
You can see one of these installations near you.

NIAGARA BLOWER COMPANY
405 Lexington Ave. New York 17, N. Y.
District Engineers in Principal Cities of United States and Canada

WHO'S WHAT . . .

▸ *PYLE-NATIONAL CO.*—George K. Raider, division manager in charge of railroad and turbine sales; Robert S. Geocaris, a similar post in charge of commercial sales of "Multi-Vent" air distribution systems.

▸ *BROWN FINTUBE CO.*—J. B. Carpenter, sales manager for packaged boiler division.

▸ *NATIONAL ASSOCIATION OF FAN MANUFACTURERS, INC.*—Newly elected officers: C. C. Cheyney of Buffalo Forge Co., president; R. W. Nelson of American Air Filter Co., vice president; G.W. McCormick, Jr. of the Association, secretary-treasurer. Elected to the board of directors with Mr. Cheyney as chairman: H.E. Barth of American Blower Corp., R. G. Lubinsky of Trane Co., Mr. Nelson and Mr. McCormick.

▸ *FEDDERS-QUIGAN CORP.*—Anthony J. DeFino, vice president in charge of sales.

▸ *TRION, INC.*—Robert H. Maloy, advertising and sales promotion manager. He replaces Richard E. Sweitzer, promoted to assistant sales manager.

▸ *O. A. SUTTON CORP.*—Bob Farris, advertising manager.

▸ *TUBE TURNS*—W. C. Robinson, an assistant sales manager. Mr. Robinson will have an important role in sales promotional programs inaugurated in the company's eastern division territories.

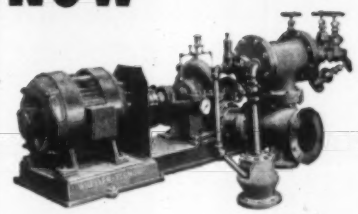
▸ *ALUMINUM CO. OF AMERICA*—Richard L. Templin, honorary member in the American Society for Testing Materials. Mr. Templin is assistant director of research and chief engineer of tests for Alcoa. M. Scott Hunter and William G. Fricke, Jr. of Alcoa's aluminum research laboratories are recipients of the Richard L. Templin Award for their paper, *The Metallographic Aspects of Fatigue Behavior*. All awards were presented at the ASTM annual meeting.

▸ *J. A. ZURN MFG. CO.*—Thomas A. Kennedy, assistant to the president; John Henry Zurn, vice president and general manager; Albert A. Baker, vice president of sales; John L. Derby, director of manufacturing.

▸ *RIDGE TOOL CO.*—D.H. Rowe, assistant sales manager.

▸ *AMANA REFRIGERATION, INC.*—E. L. Hinchliff, special merchandising consultant. J. A. Rishel, Jr. succeeds Mr. Hinchliff as general sales manager.

PROVIDE FOR FIRE PROTECTION NOW



with a

WHEELER-ECONOMY FIRE PUMP

A delay in the planning or completion of your fire protection program may mean loss of life, property or operation. For a complete and effective plan include one or more Underwriters Laboratory and Factory Mutual Fire Insurance Companies approved Wheeler-Economy Fire Pumps.

Write for catalog **L-154**

WE-510

WHEELER-ECONOMY

ECONOMY PUMPS, INC. • DIVISION OF
C. H. WHEELER MANUFACTURING CO.
19TH AND LEHIGH, PHILADELPHIA 32, PA.

KENNEDY

gives you the answers to your Valve questions . . .

with the *New* KENNEDY VALVE Check Charts . . .

show you at a glance *How, When, Where* to use the correct valve to fit the job!

Now you can tell at a glance the correct KENNEDY Valve to use on a specific job . . . and why! These new valve Check-Charts show you the important features of the various types of KENNEDY Valves and explain their proper installation and use. Show you which valves go where . . . list specific Figure Numbers for accurate selection . . . describe why that valve should be used . . . and even suggest additional uses for Kennedy Valves.

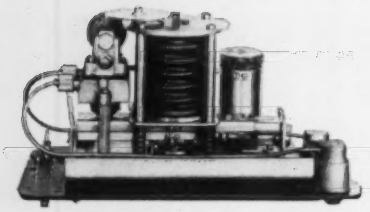
One chart describes Kennedy Bronze Valves and its companion chart lists uses and conditions for Iron-Body Valves.

Designed for fast, easy reference, contains the answers to most of your valve questions. Large enough (16½" wide x 25" deep) for easy reading and hangs right on your wall in your office or shop.

Here are long-needed valve Check-Charts that give you quick, correct information and show you how and why certain valves are built for specific jobs. Get your Kennedy Valve Check-Charts today!

• GET YOUR KENNEDY VALVE Check Charts NOW! . . . ask your nearest KENNEDY Distributor or WRITE direct.

THE **KENNEDY** VALVE MFG. CO.
1021 E. WATER ST. ELMIRA, NEW YORK
• VALVES • PIPE FITTINGS • FIRE HYDRANTS
OFFICE-WAREHOUSES IN NEW YORK, CHICAGO, SAN FRANCISCO • SALES REPRESENTATIVES IN PRINCIPAL CITIES



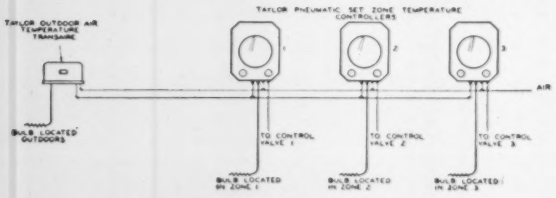
HIGHLY ACCURATE REMOTE CONTROL

with Taylor TRANSAIRE Temperature Transmitter*

THIS compact, super-responsive temperature transmitter is particularly adaptable where zones are remotely located from a centralized control room. The point of measurement can be 1000 ft. or more away from the control panel—there are no long thermal systems involved.

Short, shiftable range spans give a remarkable degree of accuracy—½% of the range span on critical applications. A 50° range span can be continuously adjusted within range limits of 0 to 150°F., covering cold, normal and hot applications all in one instrument. 100, 200 and 400 degree range spans are also available.

Drawing shows how a number of Pneumatic Set Zone Controllers can be automatically adjusted by one TRANSAIRE Temperature Transmitter.


TAYLOR PNEUMATIC SET ZONE TEMPERATURE CONTROLLERS
TAYLOR OUTDOOR AIR TEMPERATURE TRANSAIRE
AIR
BULB LOCATED OUTDOORS
TO CONTROL VALVE 1
TO CONTROL VALVE 2
TO CONTROL VALVE 3
BULB LOCATED IN ZONE 1
BULB LOCATED IN ZONE 2
BULB LOCATED IN ZONE 3

Ask your Taylor Field Engineer, or write for **Catalog 5.** Taylor Instrument Companies, Rochester, N. Y., or Toronto, Canada.

*Reg. U.S. Pat. Off.

Taylor Instruments
MEAN ACCURACY FIRST

WHO'S WHAT

Continued

▸ *A. O. SMITH CORP.*—C. S. Pester, works manager for the Permaglas Div. He succeeds R.E. Friend who has been relieved of that portion of his duties to concentrate fully on the activities of assistant general manager of the division. William Watson replaces Mr. Pester as manufacturing superintendent.

▸ *ARMSTRONG CORK CO.*—F. S. Donnelly, manager of industrial insulation sales, a new management function in the company.

▸ *W. W. McMILLAN AND CO.*—Frank B. Wilder, chief engineer in manufacture and sales of "Comfort-aire" heat pump air conditioning units.

▸ *TRANE CO.*—A.J. Hackl, director of sales of self contained air conditioners; William H. Stahlheber, assistant to manager of process heat transfer department; Jack F. Eckelaert, appointed to unit heater sales department.

▸ *WALWORTH CO.*—Dr. Forest C. Monkman, Jr., head of newly formed research and development division.

▸ *INDUSTRY ADVISORY COMMITTEE to the UNDERWRITERS LABORATORIES*—Ralph S. Lowenson, chief engineer for O.A. Sutton Corp.; F.J. Scire, chief engineer for the air conditioning division of Mitchell Mfg. Co.; W.G. Spieglhalter, engineering manager for General Electric Co.; M.C. Stevens, room air conditioning engineer, York Corp.; P.W. Wyckoff, chief engineer, Chrysler Corp.

▸ *AMERICAN RADIATOR & STANDARD SANITARY CORP.*—William P. Sheehan, manager of advertising and sales promotion for the air conditioning division. Mr. Sheehan's activities will include the company's commercial packaged air conditioner line. He succeeds R. Henry Shine, resigned.

▸ *NORMAN PRODUCTS CO.*—John C. Booton, director of sales.

▸ *STERLING ELECTRIC MOTORS, INC.*—Edgar K. Johnston, vice president in charge of manufacturing; John R. Eastman, chief engineer.

▸ *ELECTRO DYNAMIC DIV., GENERAL DYNAMICS CORP.*—William L. Pharmer, assistant sales manager.

▸ *E. I. DU PONT DE NEMOURS AND CO.*—Wallace E. Gordon, director of advertising department. He succeeds William A. Hart, retiring.

SAVE TIME and MONEY when you form FLEXIBLE CONNECTORS

use *"engineer approved"*

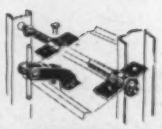
ELGEN SILENT DUCT

*Pats. Pend.

Imagine, this one-piece, factory-assembled metal-to-material unit unrolls absolutely *flat!* No more bothering with unwieldy duct material that buckles easily. Elgen Silent Duct makes on-the-spot work a cinch . . . you just measure and cut. You can fabricate *any type* of flexible duct connector in minutes . . . with half the effort! You can save up to 60%! No more worry about an inventory of "made-up" parts, either. Your choice of U.L. approved, (Gov't. Spec. Mil-D-10860) canvas, *Johns-Manville* asbestos and *U. S. Rubber* neoprene coated fibre glass, in 3" or 6" widths attached to 24 or 26 gauge galvanized steel or 24 gauge aluminum to fill every job requirement. All available in handy-to-use 25, 50 or 100 foot rolls.

2 More Elgen Products That Put Profits In Your Pocket!

ELGEN ALL-TITE VANE RUNNER
• Quickest and easiest way ever devised for installing turning vanes for square elbows • No special tools required; vanes lock easily with blow of hammer



ELGEN DAMPERSET
For Multi-Blade Dampers . . . Parallel or Opposed • Most perfect damper hardware developed • Assembles in a jiffy . . . cuts assembly time in half • Easily adjusted and self-aligning. Licensed by Minneapolis-Honeywell

ELGEN PRODUCTS ARE SOLD THROUGH LEADING JOBBERS EVERYWHERE.

"Put Profits In Your Pocket!"

Write today for free catalog and "spec" sheet! Dept. E-9

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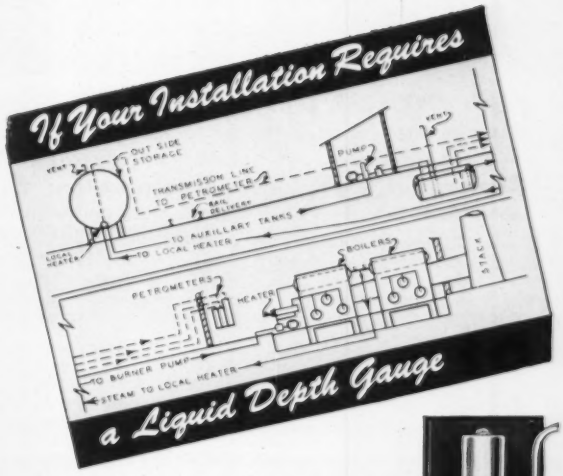

Specify:

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REMOTE READING

TANK GAUGES

THE BEST GAUGE FOR:

Commercial and Industrial Fuel Oil Tanks

Domestic Installations with Buried Tanks

Storage Tanks for other liquids—gasoline, solvents, acids, etc.

Here's Why:

No troublesome moving parts—operates on the sound principle of the U-tube. Simple, dependable and accurate.

Large, easy-to-read vertical scale gives tank contents at a glance. Eliminates the cumbersome measuring stick and the inconvenience of climbing the tank.

Installation is easy—gauges can be installed on tanks above or below ground level and up to ¼ of a mile away. The tank assembly for the gauge can be installed even when the tank contains liquid. It can also be fitted in the tank separately to complete the tank work. The gauge can be connected any time later. Just tighten one simple connection and the job is finished.

FOR TANKS 20 INCHES TO 50 FEET DEEP. *Write for Bulletin PV.*

LIQUIDEPTH INDICATORS, INC.

43-22 TENTH ST., LONG ISLAND CITY 1, N. Y.

WHO'S WHAT

Continued

▸ *AIR PRODUCTS, INC.*—William H. Thomas, director of the general industrial equipment division, Business and Defense Services Administration, U. S. Department of Commerce. Mr. Thomas, manager of government sales for Air Products, will serve in the federal post on loan from his company and without compensation from the government.

▸ *TUBE TURNS*—Frank Briggs, appointed to staff of sales development department.

▸ *SERVEL, INC.*—Burton Brown, assistant manager of credit and collection department; Homer W. Harrison, budget director duties broadened to include timekeeping and tabulating departments.

▸ *PERFECTION INDUSTRIES, INC.*—Manning E. Case, Jr., a member of the board of directors. Mr. Case is Perfection's secretary and treasurer and general counsel.

▸ *ARMOUR RESEARCH FOUNDATION OF ILLINOIS INSTITUTE OF TECHNOLOGY*—Otmar E. Teichmann, manager of the heat-power research department. Mr. Teichmann was formerly associate manager of that department.

▸ *BUILDING RESEARCH INSTITUTE*—Edmund Claxton, president. Mr. Claxton is director of research for the Armstrong Cork Co.

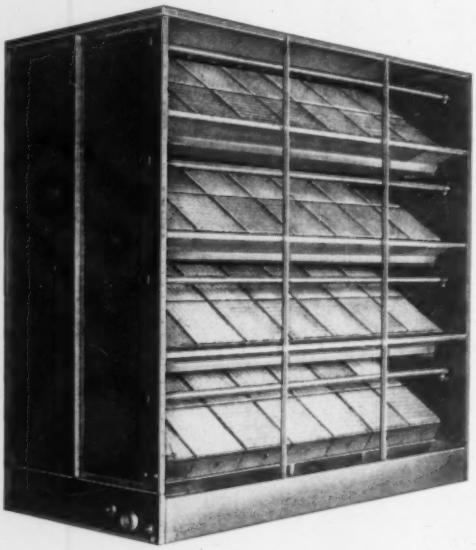
▸ *VIKING AIR CONDITIONING DIV., NATIONAL-U.S. RADIATOR CORP.*—J.G. Baker, manager of application engineering.

▸ *JOSEPH T. RYERSON & SON, INC.*—Merle A. Miller, vice president and treasurer; Raymond N. Carlen, vice president; Emery R. Walker, service consultant reporting to the vice president in charge of operations; Robert D. Allison, manager of the service department of the Chicago plant, the post vacated by Mr. Walker.

▸ *BRUNNER MFG. CO.*—Albert G. Zumbrun, permanent panel member and member of board of directors of American Arbitration Assn. Mr. Zumbrun is president of Brunner.

▸ *DAY & NIGHT DIV. OF CARRIER CORP.*—George Kelley, manager of heating and air conditioning.

▸ *BUSH MFG. CO.*—C. L. Babin, head of newly formed export department. He was formerly assistant director of sales.



CAPILLARY* AIR WASHERS

are

EFFICIENT & VERSATILE

DEHUMIDIFIERS
HUMIDIFIERS
FILTERS
SCRUBBERS
EVAPORATIVE COOLERS
WATER COOLERS

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***TRADE MARK REG.**

AIR & REFRIGERATION CORPORATION

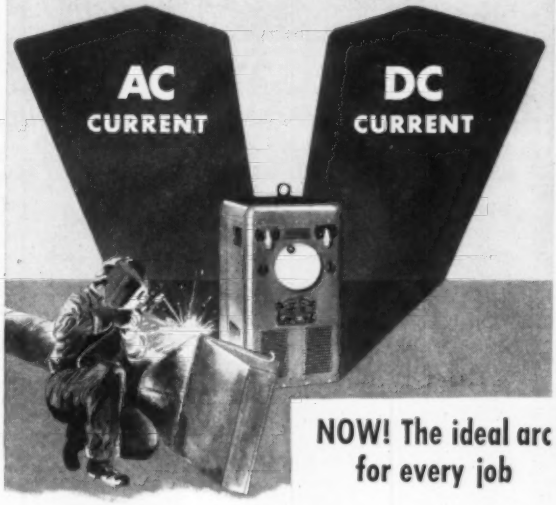
439 MADISON AVE. · NEW YORK 22, N.Y. · ATLANTA, GA.

SALES REPRESENTATIVES IN PRINCIPAL CITIES

A&R

Now... for the price of a DC welder

ONE WELDER with BOTH AC and DC WELDING CURRENT



NOW! The ideal arc for every job

Lincoln IDEALARC

gives you:

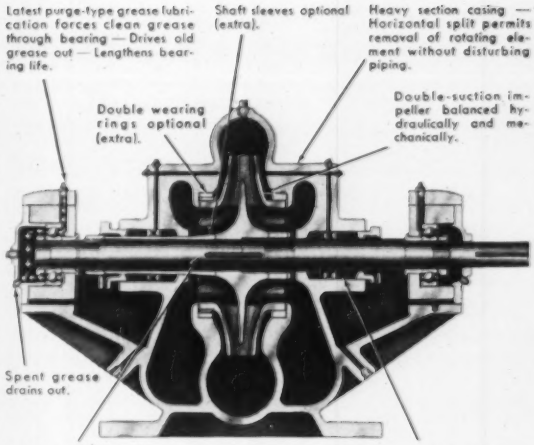
- *both AC and DC welding current*
- *dual arc control for both voltage and current*
- *arc-booster starting on DC as well as AC*
- *operation on single phase power*

With Idealarc, you can cut duplication of welding equipment and save money on welder cost. That's because Idealarc can be furnished as a straight AC welder and a DC unit can be added at any time to give you *both* AC and DC welding current.

GET THE FACTS ON IDEALARC
Write for Bulletin 1343

THE LINCOLN ELECTRIC COMPANY
Dept. 3804
CLEVELAND 17, OHIO

The World's Largest Manufacturer of Arc Welding Equipment

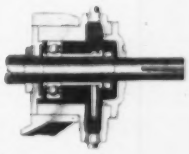

Latest purge-type grease lubrication forces clean grease through bearing — Drives old grease out — Lengthens bearing life.
Shaft sleeves optional (extra).
Heavy section casing — Horizontal split permits removal of rotating element without disturbing piping.
Double wearing rings optional (extra).
Double-suction impeller balanced hydraulically and mechanically.
Spent grease drains out.
Stainless steel shaft without sleeves is standard.
Extra-deep stuffing boxes take either conventional packing or mechanical seals.

New Purge-type Grease Lubrication

CUTS PUMPING COSTS

on American-Marsh Type HLM and HIM Split Case Centrifugals

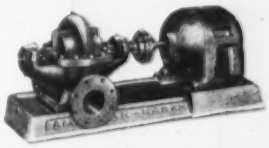
What does Purge-type Grease Lubrication offer you? Just this: By pushing out spent or dirty grease every time bearing is lubricated, it adds years of extra bearing service. That means less maintenance and longer pumping service from your total investment.



Ring-oiling ball bearings are also available (optional).

Many other superbly engineered features combine to eliminate interruptions and cut costs for A-M owners. Study the drawing a moment — You'll notice extra deep stuffing boxes and other details that are better designed, better built than ordinary pumps.

Then write for new HLM-HIM Bulletin 350, with full details and performance data.



HLM and HIM pumps are famous for low-cost service.

Pumps and Pumps only Since 1873

AMERICAN-MARSH PUMPS
BATTLE CREEK MICHIGAN

In Canada:
American-Marsh Pumps (Canada) Ltd., Stratford, Ont.

CENTRIFUGAL, TURBINE, STEAM AND POWER PUMPS FOR TESTING, PROCESSING, BOILER FEED, FIRE PROTECTION, ETC

For EVERY CONDENSATE RETURN JOB

AURORA
has the COMPLETE ANSWER

For example

APCO-MATIC VERTICAL

COMPACT • EFFICIENT • QUIET • DURABLE • DEPENDABLE

CONDENSATE RETURN UNIT

These APCO-MATIC's combine the latest features in vertical turbine-type pump design with small space, quiet dependability, completely automatic condensate return with a minimum heat unit loss. Available for heating systems rating from 800 to 10,000 EDR and pressures up to 50 P. S. I.

CHECK THESE DISTINCTIVE FEATURES

Write for BULLETIN 113-LR

LOW RETURN OPENING
Convenient for connection to close-to-the-floor return lines.

DUAL DISCHARGE OPENINGS
Provide optional connection for piping to boiler.

BRONZE PUMPING UNIT
Insures long life and no deterioration of pump parts by corrosion.

COMPACTNESS
Rectangular receiver — maximum capacity — minimum space.

QUIET OPERATION
Close coupled pump is quiet. Pump and Motor mounted on rubber.

MECHANICAL SEAL
Eliminates all leakage. Keeps floor dry and clean.

MAINTENANCE
Replacement of worn parts or complete unit without disturbing piping connections.

OTHER CONDENSATE RETURN UNITS by AURORA

Whether returns are high, low or below floor level Aurora has horizontal and vertical units, simplex and duplex, for practically every size of condensate return problem. Describe your applications; we'll send you bulletins.

Complete Information on Request

DISTRIBUTORS IN PRINCIPAL CITIES

AURORA PUMP DIVISION
THE NEW YORK AIR BRAKE COMPANY
80 LOUCKS STREET AURORA • ILLINOIS

WHO'S WHAT

Continued

▸ *CRANE CO.*—Jess A. McMurry, director of branches. He was a district manager with headquarters at Dallas.

▸ *MARATHON ELECTRIC MFG. CORP.*—Walter M. Bohne, sales promotion and advertising manager. For the past two years Mr. Bohne has been engaged in special research projects carried on by Nilson Mfg. Co. and UARCO, Inc.

▸ *RHEEM MFG. CO.*—Gordon W. Mallatratt, a vice president.

▸ *McQUAY, INC.*—Wesley H. Markson, manager of sales promotion department.

▸ *KAISER ENGINEERS*—T. A. Bedford, returned to company's home office in Oakland.

▸ *REFRIGERATION ENGINEERING, INC.*—Richard D. Quinn, personnel director.

▸ *BRISTOL CO.*—Ernest Nuber, general field sales manager.

IN THE TERRITORIES . . .

(Recent sales appointments)

▸ *BELL & GOSSETT CO.*—J. A. Ivester, manager of a new Boston sales office. William S. Warner, formerly with the home office sales and engineering departments, will join the Boston office personnel.

▸ *DETROIT CONTROLS CORP.*—C. William Wright, representative for refrigeration and heating controls in northeastern Ohio.

▸ *CONNOR ENGINEERING CORP.*—Starnes & Glass., representative for Ohio, part of Pennsylvania.

▸ *RELIANCE ELECTRIC & ENGINEERING CO.*—Peterson Nesbit, transferred to Boston sales office as sales engineer in New England district; Charles Robert Sargeant, a similar assignment in the New York office, succeeding Mr. Nesbit.

▸ *WOLVERINE TUBE DIV. OF CALUMET & HECLA, INC.*—Gerald S. Feild, sales representative for Georgia. North California sales offices have been moved from San Mateo to San Francisco.

▸ *MERCOID CORP.*—Jensen Instrument Co., California distributor.

MERCOID®
PRESSURE CONTROLS

FOR OUTDOOR SERVICE

HERE'S ANOTHER MERCOID PRODUCT DESIGNED TO OUTPERFORM AND OUTLAST ORDINARY TYPES OF PRESSURE CONTROLS.

Conforms to Nema specifications 1A (semi-dust tight), 2 (drip tight), 3 (weather resistant, weather proof, splash proof, sleet proof, moisture resistant and rain tight), 4 water tight (hose test).

The case and cover are zinc plated steel having a coating that will withstand a 50-hour salt spray test. The cover provides for visible inspection of the sealed Mercoid mercury contact and the calibrated dial. Adjustments are external. Electrical connection is made by means of a $\frac{1}{2}$-inch tapered pipe protruding back of control case.

IT'S AVAILABLE IN
17 DIFFERENT PRESSURE RANGES
FROM 0-30" VAC. TO 300-2500 P.S.I.
WITH THE SENSITIVITY YOUR APPLICATION REQUIRES

WRITE FOR BULLETIN 14 PW

THE MERCOID CORPORATION
4201 BELMONT AVE., CHICAGO 41, ILLINOIS
New York: 205 E. 42nd Street • Philadelphia: 3137 N. Broad Street

Hospital in Montgomery, Alabama, equipped with No. 5 Lo-BLAST Burner

FOR EVERY TYPE OF BUILDING

LO-BLAST
IS THE GAS HEATING "BUY"

From coast to coast, you'll find Lo-BLAST Power-type Conversion Gas Burners heating buildings ranging from small residences to entire villages heated from a central plant. Preference for Lo-BLAST springs from proved efficiency, safety, durability . . . *operating records show an average saving of* 10%!

Compare these operating and construction features:

Power Burner Design. Perfect combustion, regardless of draft—a proved fuel saver. Safe and efficient for down-draft units.

Simple to Install. Every Lo-BLAST is factory tested on gas and shipped assembled.

Safe Operation. Lo-BLAST comes equipped with dependable, foolproof safetys.

Soft, Quiet Flame. No "pop" when the Lo-BLAST goes on or off—burns so smoothly you can hardly tell it's running.

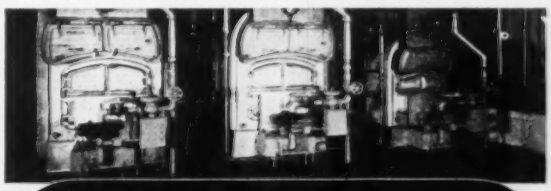
Easy to Service. All parts are accessible—nothing in the firebox but the fire. Simplicity of design and durable construction reduce service to a minimum.

Long Lasting. Many Lo-BLAST Burners have been in operation 15 years without service.

Complete Capacity Range. Units available from 70,000 to 20,000,000 BTU input.

The "mighty-mite" of conversion gas burners—capacities from 70,000 to 500,000 BTU. All the famous design features of the larger Lo-BLAST packed into a low-cost unit for residential use. Write for descriptive literature.

This battery of Lo-BLAST Burners handles 11,000 sq. ft. of steam radiation plus 10,000 gallons of hot water per day.



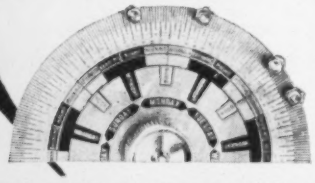
MID-CONTINENT
METAL PRODUCTS CO.
1960 N. Clybourn Ave., Chicago 14, Ill.

Cut customer fuel bills 7 days a week

it's good business to always install a PARAGON 700 Series Calendar Time Switch on commercial heating units

YES, the good word gets around fast when a Paragon 700 Series Time Switch is on the job cutting heating bills. Heat is *automatically turned off* when not needed. Customer satisfaction through lower fuel bills *plus* fewer service "call backs" are big profit boosters for you! Check these features: :

- **COMPLETELY FLEXIBLE** — completely economical. Switch settings can be made for the entire week's schedule, yet easily and quickly changed. ON-OFF or OFF-ON operation can be as close as 3 hours.
- **FULLY AUTOMATIC** — set it, then forget it. Saves money weekends, for example: switch may be set to cut off heat Saturday noon, then automatically start regular heating cycle earlier than usual Monday.
- **INSTANTLY CHANGEABLE** — simply set the dial trippers at desired day or night hours. Total of 14 are supplied as standard equipment.



Ask for Bulletin HP-5407

See your jobber, or write: Dept. 1811

Dial is graduated in hours and half-hours. Night and day periods clearly separated. Available in 24, 120 and 240 volts; 25, 50 and 60 cycles. No complicated wiring. Lists as low as $28.50.

PARAGON ELECTRIC COMPANY

TWO RIVERS, WISCONSIN

World's Foremost Manufacturer of Time Controls

WHO'S WHAT

Continued

▸ *L.O.F. GLASS FIBERS CO.*—Newly appointed sales managers and their regions are: Thomas L. Carver, eastern; John B. Banks, central; Ken C. Settelmyer, midwest; Robert E. Simpson, southwest. District managers within Mr. Settelmyer's territory are: Arthur S. White, St. Louis; Norman C. Plass, Minneapolis. Field representatives are: Edward A. Turner, Chicago; James T. Gander, Milwaukee; Malcolm C. Brown, Kansas City. Robert N. Heyman is district manager of the Dallas area in the southwest region.

▸ *TRANE CO.*—Sales office managerial appointments are: S. Rowe Hill, Oklahoma City; Banks W. Clark, Dallas; Jack Rule, Little Rock.

▸ *SPORLAN VALVE CO.*—Frank L. Vaughn, manager of Birmingham branch covering Alabama, Mississippi, parts of Louisiana, Florida, Tennessee.

▸ *McQUAY, INC.*—Raymond B. Hoctor, representative for Texas, Oklahoma, Louisiana, southern Mississippi; W. O. Johnson, for Colorado, Nevada, Utah, Arizona.

▸ *ZATKO METAL PRODUCTS CO.*—Frank B. Gibbons, sales agent for Cleveland area.

▸ *DRAYER-HANSON, INC.*—Joiner-Meade-Capers, Inc., territory increased to include Dallas, the Texas Panhandle, five counties in New Mexico.

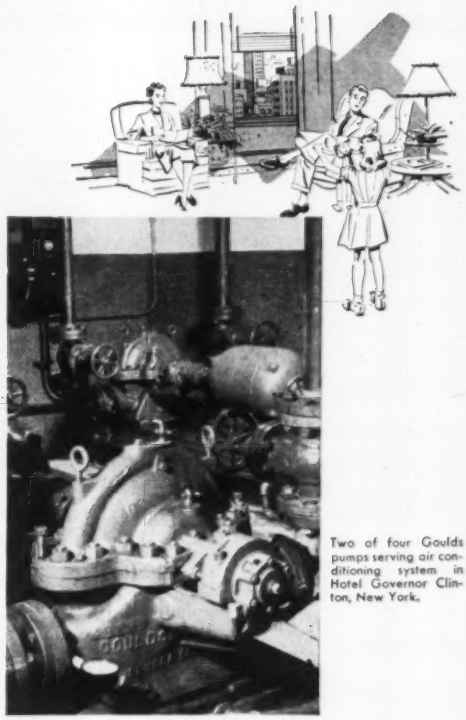
▸ *CRANE CO.*—R. G. Hunter, district manager with headquarters at Dallas. He has been manager of the Tulsa branch office since 1946.

▸ *REVCOR*—Don E. Arnold & Assoc., sales engineering representative in Michigan, northern Indiana; Jubell Assoc., a similar appointment for northern Ohio, northwestern Pensylvania.

▸ *SPENCER HEATER, LYCOMING DIV.-AVCO MFG. CORP.*—Associated Sales Engineering Co., sales representative for Oklahoma, New Mexico; Joseph Y. Fowler, for northern New York State; Kay Engineering Co., for Nebraska, Iowa.

▸ *AMERICAN BLOWER CORP.*—V. C. Warfield, western division merchandise manager located in Chicago.

▸ *CLEAVER-BROOKS CO.*—Barret & Yost Co., representative for sale of boilers and equipment in most of Washington and parts of Idaho.



Two of four Goulds pumps serving air conditioning system in Hotel Governor Clinton, New York.

These pumps insure cool comfort for

Governor Clinton's guests

With 1,200 rooms to air condition, New York's Hotel Governor Clinton needs pumps it can depend on.

That's why the hotel's management selected Goulds pumps for their new air conditioning system. They knew the Goulds reputation for efficient operation and long, trouble-free service.

Three 2½" Goulds Fig. 3480 pumps handle this day-and-night assignment. Each has a capacity of 300 GPM under a 90-ft. head, and circulates water to the 200-ton cooling tower on the 29th floor. A smaller Goulds Fig. 3460 pump with a 90 GPM capacity handles the pumping job during low-load periods.

You, too, can insure efficient operation, and years of uninterrupted service, by specifying Goulds pumps for your air conditioning installations. There are models and sizes for every requirement.

Your Goulds representative will welcome an opportunity to help you select the right pumps to suit your needs. Or write directly to our home office in Seneca Falls. Your inquiry will receive prompt attention.

MEMBER

Goulds PUMPS INC.
Seneca Falls New York

Atlanta • Boston • Chicago • Houston • New York • Philadelphia • Pittsburg • Tulsa

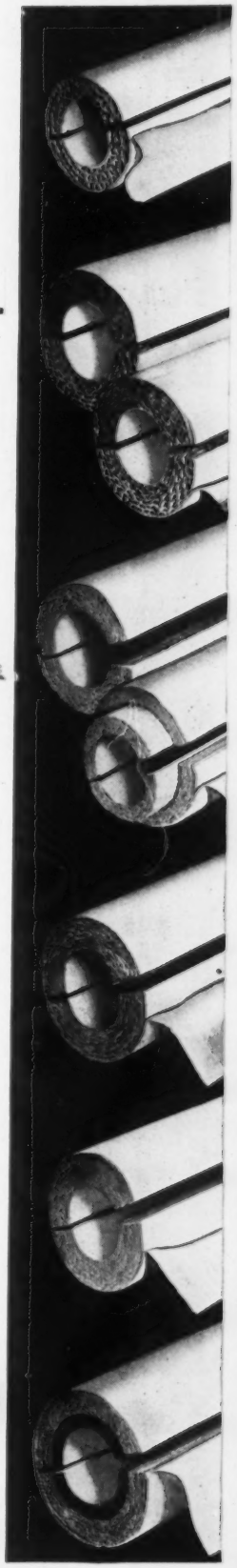
For
HIGHEST QUALITY
in
LOW-PRESSURE
PIPE COVERINGS . . .
be sure to
specify–

Sal-Mo

Prompt service
at all times
on a complete
line of pipe
insulation for hot,
cold and chilled
water and steam
lines.

Your inquiries will receive our prompt attention.

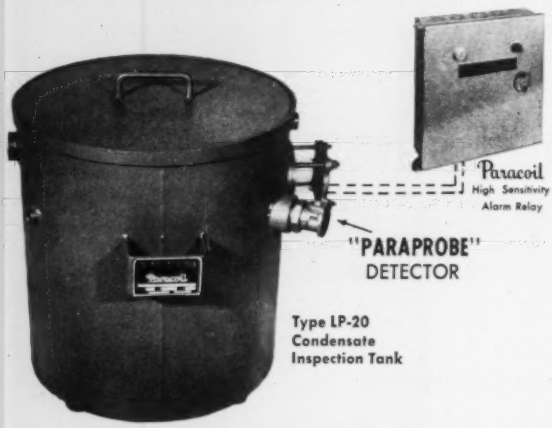
SALL MOUNTAIN COMPANY
HAMILTON, OHIO



IT'S

NEW!

Paracoil OIL-LEAK DETECTION SYSTEM for STEAM TYPE FUEL OIL HEATERS



Continuously Monitors the Purity of Condensate leaving Steam-Type Fuel Oil Heaters

- Isolates all fuel oil entrained in the condensate stream
- Gives alarm to plant Personnel
- Protects the boiler by removing oil contamination from feed-water cycle
- Applicable to both low and high pressure steam plants
- Engineered to the special requirements of each installation

Write for further details

DAVIS ENGINEERING
CORPORATION
30 Rockefeller Plaza, New York 20, N. Y. 1064 E. Grand Street, Elizabeth 4, N. J.

Paracoil's skill to do comes of doing . . . Since 1915

WHO'S WHAT

Continued

▸ *"KINETIC" CHEMICALS DIV., E.I. DU PONT DE NEMOURS AND CO.*—Charles Wirth III and Norman W. Kent, managers of newly established independent New York and Chicago district sales offices, respectively; Samuel N. Seely, sales supervisor in Los Angeles district; Leonard Waller, manager of export sales section in Wilmington, Del., succeeding Mr. Seely; Richard H. Hoffman, sales correspondent in Chicago office; Douglas H. McKenna, sales representative for "Freon" refrigerants and aerosol propellents in Milwaukee.

▸ *YORK-SHIPLEY, INC.*—Distributors and territories are: S. C. Bratton Sales Engineers, Ltd., Alabama; Stromquist Co., Georgia; Agair Corp., Illinois; James W. Vanderpool, Maine; DeGidio Oil Burner Sales, Minnesota; William J. Goff and Son, New York; Tennessee Heating Co., Tennessee.

▸ *FIELD CONTROL DIV.*—John A. Sandberg, agent for draft controls for Wisconsin, Minnesota, the Dakotas.

▸ *PREFERRED UTILITIES MFG. CORP.*—Pure Fuel Oil Co., sales and service representative in Chicago area for industrial and commercial oil burners and accessories.

▸ *AMERICAN RADIATOR & STANDARD SANITARY CORP.*—Francis J. McGrath, manager of the New England sales district for the plumbing and heating division.

▸ *CARRIER CORP.*—Ray A. Tritten, assistant to the general manager of West Coast divisions.

▸ *J. F. PRITCHARD & CO. OF CALIFORNIA*—Tate Engineering & Supply Co. and Cone and Wallace Co., sales representatives for Maryland and Arizona, respectively.

▸ *J. A. ZURN MFG. CO.*—L. W. White, vice president of Zurn Services, Inc., the firm's East Coast marketing organization. He will supervise sales in New York, New Jersey, Vermont, Massachusetts, New Hampshire, Rhode Island.

▸ *PEERLESS PUMP DIV., FOOD MACHINERY AND CHEMICAL CORP.*—C. Scott Hoeppner, branch manager of new factory sales office in San Francisco.

▸ *GUSTIN-BACON MFG. CO.*—Clark M. Page, Kansas City district sales manager. The district covers Missouri, Kansas, Oklahoma, Colorado, Wyoming, Nebraska, Iowa, South Dakota.

Kansas City goes "big league"
...installs

PENN VENTILATORS

in Municipal Stadium

Penn Dynafans serve the new locker room facilities for the newest entrant in the American League. Inconspicuous and easy to maintain, these units are depended upon to exhaust warm, moist air quietly. Many industrial and commercial ventilation problems are easily and inexpensively solved by these versatile units. Count on the Penn Ventilator man in your area for qualified and complete assistance on your next ventilation problem.

Complete literature available — write to Engineering Department

PENN VENTILATOR COMPANY

PHILADELPHIA 40, PENNA.

Representatives and Distributors in Principal Cities

Member of the Power Fan Manufacturers Association

In Eastern Canada: **Air-Care, Ltd.**
2125 Marcil Ave., Montreal 28, Que.

There are

21 BASIC INDUSTRIES

and

HENDRICK

Serves Them ALL!

That's right! Hendrick serves every one of the 21 basic industries designated by the U. S. Department of Commerce under its Standard Industrial Classification list. If you have a perforating problem and are not already familiar with Hendrick's facilities, we stand ready to serve you, too!

Whatever your needs be, if you wish to perforate metal, rubber, plastic or masonite for a screening, straining, decorative, display or acoustical application, Hendrick's long experience can be of real help. Join the long list of manufacturers who now derive untold assembling and selling benefits by using Hendrick Perforated Metal as a fabrication material. Call Hendrick today.

Hendrick
MANUFACTURING COMPANY

48 DUNDAFF ST., CARBONDALE, PA. • *Sales Offices in Principal Cities*
Perforated Metal • Perforated Metal Screens • Wedge-Slot Screens • Architectural Grilles • Mitco Open Steel Flooring • Shur-Site Treads • Armorgrids

ONE HAND CONVENIENCE
for fastening to steel or concrete
Ramset Fasteners INC
Ramset
FASTENING SYSTEM
SPEEDS WORK ON LADDERS & SCAFFOLDS
+
other Ramset exclusives:
• FAST CHANGEOVER for light, medium, heavy duty
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• PIN-POINT CONTROL for accuracy and speed
• NEARBY SERVICE whenever or wherever you need it
• FASTENING LEADERSHIP keeps Ramset FIRST in the field
For complete information, write
Ramset Fasteners, INC.
RAMSET DIVISION—OLIN MATHIESON CHEMICAL CORPORATION
12109 BEREA ROAD • • • CLEVELAND 11, OHIO

WHO'S WHAT

Continued

▸ *KRITZER RADIANT COILS*—George Mellerup, sales representative for central Iowa territory; Eugene J. Schloemer, a similar appointment for northwestern Illinois, eastern Iowa.

▸ *WORTHINGTON CORP.*—Straus-Frank Co., wholesale distributor for Dallas, north Texas area.

▸ *SERVEL, INC.*—Distributors for air conditioning products and their areas are: Hardy Corp., Birmingham; Fazio Sheet Metal Co., Joliet, Ill.; Johnston-Vest Electric Corp., Roanoke, Va.

▸ *APRIL SHOWERS CO., INC.*—Foster J. Pratt, pacific regional sales manager.

▸ *BRYANT DIV. OF CARRIER CORP.*—William E. Trageser, distributor in northwestern Pennsylvania and adjacent parts of Ohio and New York State.

▸ *MAID-O'-MIST, INC.*—John F. Templeton & Co., representative for Georgia, Alabama.

▸ *GARLOCK PACKING CO.*—Walter A. Reynolds, district manager of Denver office.

Manufacturers' Agents

Are you interested in securing additional lines?

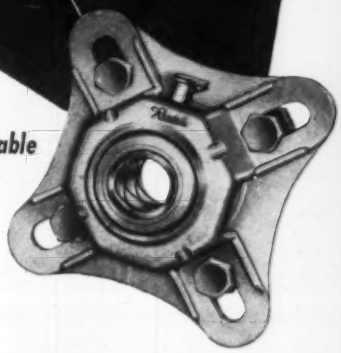
We are occasionally asked by our manufacturer advertisers to suggest the names of manufacturers' agents in various sections of the country whom they can contact in regard to representation of their industrial large building heating, piping and air conditioning products.

If you would like your name listed on our records for inquiries we may receive for your territory, we invite you to write us. There is no charge in connection with this service.

HEATING, PIPING & AIR CONDITIONING

6 N. Michigan Ave. Chicago 2, Ill.

* NEW Randall LOW COST 4-BOLT FLANGE UNIT



- *Easily Interchangeable*
- *Double Lubricated*
- *Self-Aligning*
- *Self-Lubricating*
- *Easy to Install*
- *Long Trouble-Free Service*

Randall's new 4-bolt flange is readily interchangeable with any unit having bolt hole centers from 2⅛" to 2¾". It's ideal for heavy duty application on farm implements, conveyors, textile machinery, air moving equipment, packaging machinery and other similar type equipment.

*

This new, low-cost, four-bolt flange pillow block has all the outstanding features synonymous with Randall bearings. It features the famous, exclusive Randall "deep well"® ball assembly which offers a unique double lubricating principle combining Randall's exclusive graphited bearings with grease or oil type lubricants. This assures controlled lubrication for long trouble-free operation.

Compact and light weight, the Randall 4-bolt flange is designed with slotted bolt holes which permit fast assembly and easy interchangeability. Units are shipped assembled as one piece to assure easy handling and installation. Complete information is yours for the asking—Write today!

BRONZE BAR STOCK
BRONZE BUSHINGS
PILLOW BLOCKS
SHEET LUBRICATOR

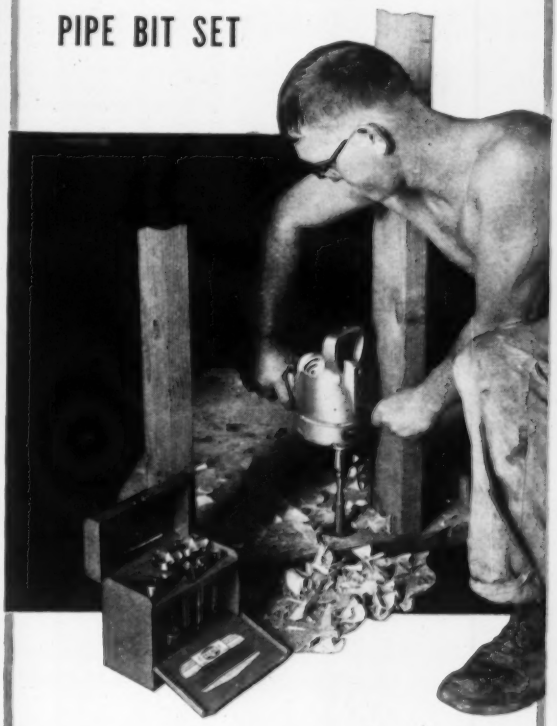
Randall

GRAPHITED BEARINGS
THRUST WASHERS
SAFETY COLLARS
BRONZE CASTING

RANDALL GRAPHITE BEARINGS, INC.

1012 S. Greenlawn Ave., Lima, Ohio

QUICKLY BORE PIPE-SIZE HOLES IN WOOD WITH GREENLEE PIPE BIT SET



Make swift, easy work of an otherwise tedious, hard job. Quickly cut clean "tailor-made" openings for ½" to 2" pipe with the GREENLEE No. 1440 Pipe Bit Set. It is designed especially for plumbers, steamfitters, and electricians to provide fast, easy boring of *smooth* holes in wood — studding, floors, joists, etc. Bits are precision made and of highest quality for long life and clean, speedy boring. Made with ½" shanks with 3 flats for use in portable electric or pneumatic drills and in stationary boring machines. An adapter is provided in the set for using the bits with standard auger-bit braces. Set also includes electric drill adapter and coupling for using standard ¾" pipe as an extension for deeper boring and longer reach. Set contains six bits for boring holes to accommodate the following pipe sizes: ½", ¾", 1", 1¼", 1½", 2". Bits, adapters, and coupling packed in an attractive, sturdy metal box with convenient carrying handle. Write today for descriptive folder.

TOOLS FOR CRAFTSMEN
GREENLEE

Greenlee timesaving tools for plumbing and heating work: Hydraulic Pipe Pushers • Hydraulic Pipe Benders • Tubing Benders • Pipe Bits Auger Bits • Spiral Screw Drivers • Chisels • And many more Greenlee Tool Co., 2349 Twelfth Street, Rockford, Illinois.

Airlouvers

have to fit...

you order them that way

Fill any wall opening with one or more weather-tight units tailored for the need

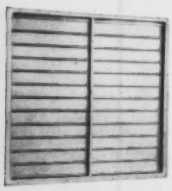
. . . without premium cost

The conveniently wide size variation in Airlouvers — the unique Swartwout louver system for industrial and commercial buildings — virtually gives you custom-made equipment at economical standard costs. Odd-size units within certain dimension brackets make it easy to fill any size opening with multiples of uniform sections.

Construction is sturdy and efficient. Strong formed channel frame houses overlapping blades that assure weather-tightness. Adjustable style Airlouver features positive closing and quick change of blade position. Several operating methods available. Made in fixed-blade style also. Write for Bulletin ALO-F.

Swartwout Industrial Louvers

Where standard size louvers can be used, this type provides maximum free opening — up to 90%, or any proportion thereof through adjustable operation of blades. Swartwout Industrial Louvers are made in single, double or triple section units of from two to twelve blades. Ask for complete description and sizes.



SEE OUR CATALOG IN SWEET'S ARCHITECTURAL AND PLANT ENG. FILES

18511 Euclid Avenue, Cleveland 12, Ohio

The Swartwout Co.

Roof Ventilators and Ventilating Louvers

POWER PLANT EQUIPMENT • PROCESS INDUSTRY CONTROLS

WHO'S WHAT

Continued

▸ *VANTON PUMP & EQUIPMENT CORP.*—D. B. Gooch Assoc., representative for Mississippi, Alabama, Tennessee, Florida, Georgia.

▸ *DERSCH, GESSWEIN & NEUART, INC.*—Pacific Scientific Co., western distributor for Wolf Linde ammonia valves and fittings.

▸ *REFRIGERATION ENGINEERING, INC.*—Refrigeration Distributors Corp., agent for "Recold" products in Idaho, Utah.

▸ *IRON FIREMAN MFG. CO.*—William M. Bolding, sales representative for metropolitan Detroit; Robert G. Duncan, district sales manager for western Massachusetts, Connecticut, Rhode Island.

▸ *TENNEY ENGINEERING, INC.*—Lee Mark Assoc., to handle sales of environmental test equipment in Kansas, Missouri.

▸ *CAPEWELL MFG. CO.*—Rueger Co., representative for Arizona, California, Oregon, Washington.

NOW is the time to consider

SNOW MELTING

Systems around Buildings and Grounds

Better send at once for our SNOW MELTING MANUAL. Here are design data based on a study of—and others' actual experience with over 100 snow melting systems of all kinds for

- LOADING PLATFORMS and DOCKS
- SIDEWALKS • ROADS • DRIVEWAYS
- MARQUEES • PARKING AREAS
- RUNWAYS • RAILWAY SWITCHES

and other applications which HAVE proved that this modern method of snow removal

Costs No More Than Other Methods

—and because snow melting by pipe coils has other distinct advantages, such as dirt-free sidewalks and entrances, and the complete elimination of ice surfaces, the demand for this method of snow removal is swiftly growing.

Complete information on the correct design, installation and operation of snow melting systems is offered in the new SNOW MELTING MANUAL, a reprint of articles originally published in HEATING, PIPING & AIR CONDITIONING.

Fifty cents will bring you this SNOW MELTING MANUAL . . . a valuable addition to your file on business opportunities.

Heating, Piping & Air Conditioning

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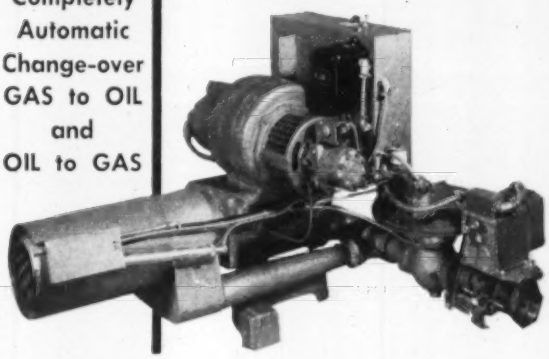
NEED STANDBY?

A COMBINATION GAS OIL BURNER WITH AUTOMATIC CHANGE-OVER

Completely Automatic Change-over GAS to OIL and OIL to GAS



Roberts-Gordon has done it again!

A completely automatic combination gas-oil burner — in three sizes! Oil capacity . . . 2½ gal. to 30 gal. . . . and available with modulating gas input . . . and 2-stage oil input.

It's compact — completely assembled and factory wired . . . and furnished with plug-in electronic controls for simple servicing!

Other ROBERTS-GORDON Industrial and Commercial Burners for Complete Heating and Processing . . .

MULTURI (Multiple Venturi) Burners

NORDENSSON POWER Burners

Write or phone for literature and details . . .

GAS HEATING EQUIPMENT

ROBERTS-GORDON

DEPT. HPAC BUFFALO 6, N. Y.

FURNACES BOILERS

UNIT HEATERS CONVERSION GAS BURNERS

Sterlco®

CONDENSATE PUMPS

HAVE THE WHOLE TRADE TALKING!

ADJUSTABLE FLOAT SWITCH, COMPLETELY WIRED!

SERIES 4200
Cast Iron Tank

EASY TO STOCK
EASY TO SELL
ATTRACTIVE TO DISPLAY

REALLY COMPACT, TOO! TAKES UP ONLY 2¾ SQ. FT. OF FLOOR SPACE

SERIES 4100
Steel Tank — same operating features

Sterlco Condensate Pumps are ruggedly built, dependable, and simple to install and maintain. Only two sizes required to take care of jobs up to 15,000 sq. ft. E.D.R. — and up to 20 lbs. discharge pressure.

For you this means less working capital tied up in floor stock.

For your customers this means future increase in radiation may not require a new pump.

Sterlco® PRODUCTS
distributed through
LEADING HEATING AND PLUMBING WHOLESALERS

FREE — "What You Should Know About Modern Steam Heating". Send for your copy.

STEAM HEATING is MODERN, EFFICIENT, and DEPENDABLE

STERLING, INC.

3732 N. Holton St., Milwaukee 12, Wisconsin

CONDENSATION AND VACUUM PUMPS

HEATING SPECIALTIES

TEMPERATURE CONTROLS

WE HEAR THAT...

▸ *AMERICAN WHEELABRATOR & EQUIPMENT CORP.* has changed its corporate name to *WHEELABRATOR CORP.* The move does not affect the company's ownership, operation or management.

▸ *WALWORTH CO.*, in pursuing new developments in the nuclear energy field, has completed arrangements for a new research laboratory to develop piping, valves and fittings for use in nuclear power systems. A major step in the company's expansion and diversification is the acquisition of the assets and business of the *M & H VALVE & FITTINGS CO.* of Anniston, Ala.

▸ Directors of *HUPP CORP.* and *PERFECTION INDUSTRIES, INC.* unanimously approved an agreement for the merger of the two companies. A vote for approval by stockholders of both companies is pending.

▸ The majority of 1400 production employees of *COPELAND REFRIGERATION CORP.* cancelled their vacation plans for this year to help the company meet its customers' requirements. The first two weeks in August are normally observed as companywide vacation time.

▸ *AMERICAN CRUCIBLE PRODUCTS CO.*, maker of "Promet" bronze bearings and wearing parts, has acquired *KENCO, INC.* Kenco has been a manufacturer of submersible pumps for sump, industrial, marine and contractor use. American Crucible's new facility will operate under the name, *KENCO PUMP DIV.*

▸ *WORTHINGTON CORP.* recently purchased a 15 acre factory site from *ELLIOTT CO.* The acquisition will be used to partially accommodate the manufacture of large central station air conditioning equipment and standard pumps.

▸ A school program for the commercial and industrial oil burning and equipment field, held at the Springfield Trade School, Springfield, Mass., has been announced by the *OIL-HEAT INSTITUTE OF AMERICA, INC.* Courses began on the Wednesday following Labor Day.

▸ The first 100 test models of a new gas powered central air conditioning system have rolled off the production line at *COBELL INDUSTRIES.* These were manufactured in the company's 25,000 sq ft plant addition started in March.

▸ Two new one story buildings which will house research and laboratory operations for *CRANE PACK-*

National Champion

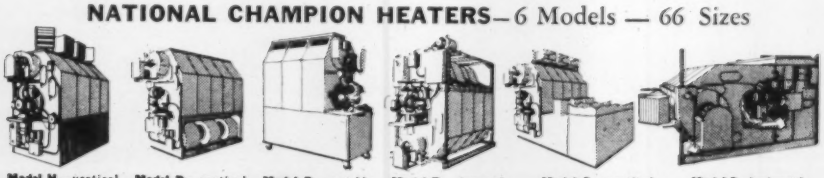
GIVES BIG LEAGUE PERFORMANCE!

Drive your heating problem "over the fence" with National Champion Heaters! Whatever your heating need—space heating, tempering, make-up air, curing, drying or de-icing—there's a National Champion to do the job. Check these winning points:

- 80% guaranteed heating efficiency
- Direct fired for gas, oil or combination fuels
- Completely automatic controls — for constant, clean heat
- 70%-150% more heat transfer area than similar units
- Quieter, smoother operation — lowest blower RPM
- Highest available external static pressures
- Electronic flame failure control
- Completely wired, assembled and flame-tested at the factory to guarantee peak performance
- Listing by Underwriters' Laboratories, Inc.

Teardrop design Combustion Chamber the "heart" of National Champions

NATIONAL CHAMPION HEATERS—6 Models — 66 Sizes



Model H—vertical unit with discharge heads. 12 sizes.

Model D—vertical unit for duct work. 12 sizes.

Model P—portable, vertical unit for flexible duty. 6 sizes.

Model R—inverted unit with discharge heads at bottom. 12 sizes.

Model S—vertical unit with side blowers to permit proper location of air mixing dampers. 12 sizes.

Model C—horizontal ceiling suspension unit for space saving. 12 sizes.

200,000 to 2,000,000 BTU CAPACITIES

Write today for complete information and specifications.

NATIONAL HEATER COMPANY, INC.
2180 Cleora Avenue, St. Paul 4, Minnesota

Announcing...

®TAPECOAT-X

The time-tested coal tar coating in tape form...now made with Xtra coating to give you these Xtra advantages

TAPECOAT-X comes in widths of 2", 3", 4" and 6". It is easy to apply and bonds readily to the surface with the flash of a torch. Wrapping is done spirally with only ½" overlap.

XTRA COAL TAR! Provides additional thickness of the same high quality coal tar that has distinguished TAPECOAT since 1941.

XTRA COVERAGE! Added coal tar thickness permits single wrap for same effective protection as present double-wrap method.

XTRA SAVINGS IN TIME AND LABOR! Faster application means lower labor cost.

XTRA SAVINGS IN MATERIAL! Single-wrapping with TAPECOAT-X requires less material, lowers cost.

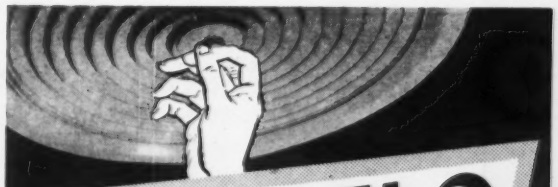
XTRA CONVENIENCE! New type, self-disposing liner facilitates unrolling, speeds application, never gets in your way.

XTRA ECONOMY! TAPECOAT-X goes farther, gives you more value for your protection dollar.

Write today for the complete facts on this timely development for protecting pipe, pipe joints, mechanical couplings, tanks and other steel surfaces vulnerable to corrosion, above and below ground.

The TAPECOAT Company
ORIGINATORS OF COAL TAR COATING IN TAPE FORM

1555 Lyons St., Evanston, Illinois



FLEXIFLO

The Diffuser for Every Application

Here's the complete diffuser line with all extra features: built-in equalizing deflectors; easy to install; quick adjustment of air volume and diffusion pattern; simplified engineering; beautifully finished in any color baked enamel.

Let our sales engineers show you why Flexiflo is better for your jobs. But first—get the Flexiflo catalog.

COOLING

Type R, constant flow pattern regardless of volume adjustment.

COOLING AND HEATING

Type V, fully adjustable air diffusion pattern and volume.

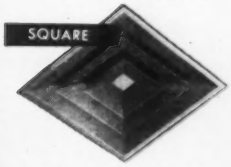
RECTANGULAR

Type MP, for 1-, 2-, 3- or 4-way diffusion to accommodate any shaped area, 16 styles.

SUPPLY AND RETURN

Type CH, adjustable for heating, ventilating and cooling.

SQUARE



Type H, adjustable volume, constant pattern and radius of diffusion.

HALF-ROUND

Type S, side wall or ceiling, with Type R or V blades for heating or cooling.

Return this coupon

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UNIVERSAL DIFFUSER CORP.
1360 GARRISON AVE., NEW YORK 59, N.Y.

Please send me complete catalog HP

NAME_____

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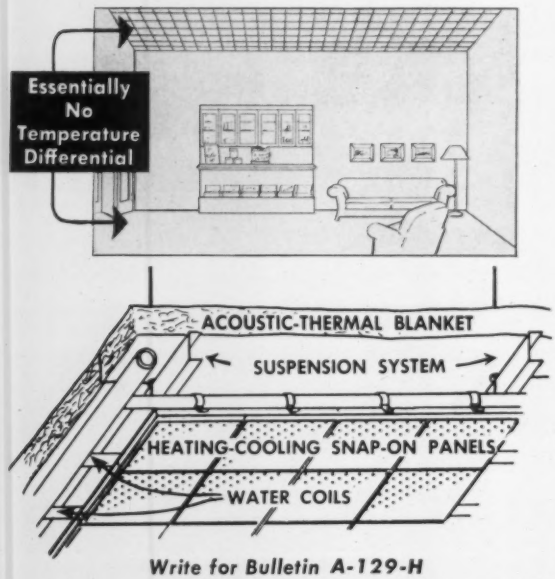
How well informed are you about the . . .

BURGESS-MANNING
3-Way Radiant Panel Functional Ceiling?

Your clients will be asking!

Yes — word is getting around, as it will when something really good makes its appearance. Here is the most modern, efficient and economical method of heating, cooling and acoustic control ever devised — it's easy to layout, easy to install and competitive in cost. No other method can provide the same uniformity of temperature with essentially no differential from floor to ceiling. It has never been done before. The Burgess-Manning 3-Way Radiant Panel Functional Ceiling is completely self-contained — suspended construction and fully automatic. Know the facts and be prepared to recommend and specify the method that offers a new versatility and substantial savings in space, material and fuel.



Write for Bulletin A-129-H

Architectural Products Division of
BURGESS-MANNING COMPANY
5970 Northwest Highway, Chicago 31, Ill.

Manufacturers of 3-Way Functional Ceilings and Telephone Acousti-Booths

WE HEAR THAT

Continued

ING CO. are under construction. The buildings, covering 46,500 sq ft, are in addition to a 126,000 plant already in operation.

▸ *REYNOLDS METALS CO.* plans to increase its primary aluminum producing capacity to 1.1 billion lb, according to an announcement by *RICHARD S. REYNOLDS, JR.*, president. This is 270 million more than the company's present capacity and calls for an expenditure of about $200 million for new facilities.

▸ *M. J. LESTER*, district manager for the *GARLOCK PACKING CO.* has concluded 50 years with the company and has retired. Mr. Lester has managed the Denver office, covering Montana, Wyoming, Utah, Colorado and New Mexico, for the last 30 years.

▸ Ground was broken in Louisville recently for an addition to *FAMCO, INC.*, a wholly owned subsidiary of *AMERICAN AIR FILTER CO., INC.* The construction will increase the plant's manufacturing area by 60 percent. Famco makes glass fiber filters for furnaces and air conditioning units and continuous roll media for automatic filters.

▸ Formation of *CARRIER-HOUSTON CORP.* with headquarters in Houston has been announced by *CARRIER CORP.* According to *CLOUD WAMPLER*, Carrier chairman and president, the new organization is being established to keep pace with the rapidly expanding air conditioning requirements in the Houston area.

▸ Evening courses on heating and ventilating, air conditioning, heating and air conditioning design, and elements of refrigeration will be offered during the fall term by *NEW YORK UNIVERSITY's* Div. of General Education. Classes will begin during the last week in September and end in January.

▸ *SUMCO ENGINEERING CO.* has announced the launching of its new "Fuel Oil Conditioning Service" to maintain clients' fuel systems and equipment.

▸ The *FORD FOUNDATION* has made a grant of $26,500 to *STANFORD RESEARCH INSTITUTE* to assist the participation of foreign scientists and engineers in the *WORLD SYMPOSIUM ON APPLIED SOLAR ENERGY*, November 1-5 at Phoenix.

▸ *CRANE CO.* has been chosen as one of the national exhibitors at Disneyland, the $17 million park opened recently at Anaheim, Calif. The company is sponsoring an exhibit in the "Tomorrowland" section of Disneyland.

How miller welders helped seal the arteries of America's largest single purpose power plant...

Substantial monument to Free Enterprise is OVEC and IKEC, suppliers of electric power to the Atomic Energy Commission's new uranium diffusion center in Pike County, Ohio.

Ohio Valley Electric Corporation and its subsidiary, Indiana-Kentucky Electric Corporation, agreed to supply electric power to this great new atomic production center . . . *15 billion kilowatt-hours annually.*

Two huge generating stations are being built: The Kyger Creek Plant at Cheshire, Ohio will have five generating units of 200,000 KW each; Madison, Indiana's Clifty Creek plant will produce 1,200,000 KW with its six big generators. Each of the eleven turbo-generating units will operate off a single boiler, with super-heated steam reaching 1,050 degrees Fahrenheit under 2,000 lbs. pressure per square inch! The high temperatures and reheat, which the sponsor companies have pioneered in their own right, will make these two plants among the most economical, most efficient generating stations in the country.

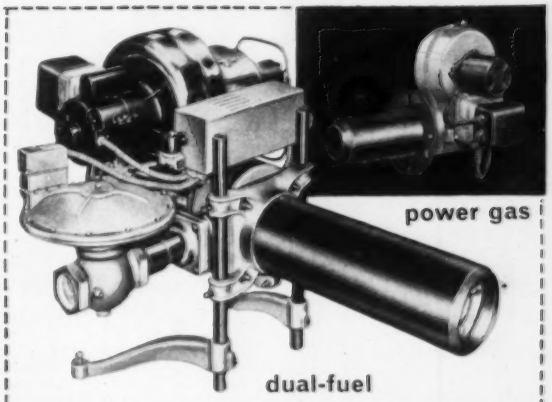
These same elements, however, make the fabrication of faultless high-pressure steam lines vital . . . and extremely difficult. To accomplish this extremely important task, pipe welding specialists equipped with the maximum of engineering skill utilized the Miller Selenium Rectifier d-c Arc Welder.

". . . . if it's Miller, you *know* it's the *finest!*"

Miller Selenium Rectifier d-c Arc Welder, in four wide-range models. For complete, concise, worthwhile information on these and other Miller Arc and Spot Welders, contact us today . . . at no obligation, of course.

miller

ELECTRIC MANUFACTURING COMPANY, INC.
APPLETON, WISCONSIN



Save $191.00 or more a month on fuel bills!

verified facts show that your processing customers can make terrific savings by burning gas in the off peak season. Here is a letter from the Aurora, Ill., AURORA FURRIERS AND CLEANERS giving concrete figures on what a tremendous saving a Syncro-Flame dual-fuel unit made for them . . . this is on just one unit . . . savings can be proportionately greater when using more than one unit.

boiler, I mentioned that there was a tremendous saving in burning gas in off-peak season. I thought you might be interested in some figures to verify my statement. I am giving you figures for a five month period comparing the cost of gas in 1954 with the cost of oil for the same period the year before.

Oil 1953		Gas 1954	
June	$306.58	June	$115.41
July	260.39	July	105.30
Aug.	232.36	Aug.	105.70
Sept.	312.82	Sept.	121.69
Oct.	299.85	Oct.	123.08
	$1412.00		$571.18

Saving over five month period $840.82

We are very happy with our Syncro-Flame burner and feel that it has almost paid for itself the first year. Also, we want to thank you and Mr. Monroe for

Automatic switching Syncro-Flame Dual-Fuel gas/oil burners burn either gas or oil with completely automatic fuel-air changeover at max. efficiency. Satisfy utility requirements as to gas availability—outside thermostat or remote manual operation. 100,000 to 4,100,000 BTUs/hr. gas—1 to 30 gals./hr. oil . . . The most reliable of all dual-fuels . . . Approved over the entire range of operation by Underwriters' Lab. Send for complete details and spec. sheets.

Syncro-Flame also produces a full line of power gas burners ranging in size from 75,000 to 4,100,000 BTUs/hr. Same dependable high efficiency flame as in dual-fuel units—swirling forced air/fuel mixture.

DUAL GAS-OIL syncro flame BURNER

synchronous flame inc.
208 n. main st., walworth, wisconsin

WE HEAR THAT

Continued

▶ A new engineering and development laboratory and offices for the engineering department of the *C. A. OLSEN MFG. CO.* was scheduled for completion this month. The $60 million laboratory will be used for testing of heating, year 'round and summer air conditioning equipment.

▶ *PANELLIT, INC.* has formed its new instrument services division "to fulfill demands for engineering facilities outside the normal range of company activities." The division will provide consulting and installation services in instrumentation and automation.

▶ "Prices of room air conditioners next year may be higher than they are now," according to *T. D. EBERHARDT*, marketing manager for the room air conditioner department of *GENERAL ELECTRIC CO.* He bases his prediction on increasing costs of materials and component parts.

▶ *REVCOR CO.* has started construction on an addition to its present factory at Carpentersville, Ill. The new addition will be 10,000 sq ft and is part of a $175,000 expansion program to increase production capacity for the company's "Blastaire" blower wheels.

▶ Members of the *PIPE TOOL MANUFACTURERS INSTITUTE* have initiated an advertising campaign to set forth the merits of threaded pipe. "Threaded Pipe—It's Tight—It's Best—Costs Less" will be used as a slogan in all their national advertising.

▶ *LESLIE CO.* has commemorated its 50th year at its present site. Visitors to the plant were given an inside look at the manufacturing processes involved in making automatic controls.

▶ *GAS APPLIANCE MANUFACTURERS ASSOCIATION* has formed a new gas unit heater and duct furnace division. *DAVID R. WEBSTER*, president of *REZNOR MFG. CO.*, has been named chairman of the division.

▶ A *Financial World* merit award for *BRUNNER MFG. CO.'s* 1954 annual report makes it three in a row for the company, and enables Brunner to compete for a bronze "Oscar-of-Industry" trophy. The award is presented for distinguished achievement in annual reporting for three consecutive years.

▶ The mobile demonstration unit, "Parade of Products," sponsored by *C. A. DUNHAM CO.*, reached the end of its 18 month tour in Denver recently. The 35 ft trailer covered 31,239 miles in 45 states.

-With The Aid Of

Phoenixspun PROCESSING METHODS

Replace ordinary sheet metal parts with streamlined, seamless fabrications that reduce production costs while improving product design. Result — increased sales appeal! — Send your prints and specifications for prompt estimates.

Metal Spinning Up to 180" Dia.

Metal Spinning Div. PHOENIX PRODUCTS CO.

4735 N. 27th Street Milwaukee 16, Wis.

INDUSTRIAL

VENTILATION

HANDBOOK

A practical manual on fume removal, dust collecting, ventilating and exhaust systems for industrial plants. Tells how to design correctly and provide for various ventilation requirements . . . make measurements and analyses of fumes, mists and dusts . . . plan exhaust systems, etc. Twenty eminent authorities contributed also to detailed descriptions of systems in actual operation in many plants, whatever the manufacturing process. 134 pages of practical "know-how" reprinted from HP&AC. Send your order with only $1.50 to get it postpaid from

KEENEY PUBLISHING CO.
6 N. Michigan Ave.
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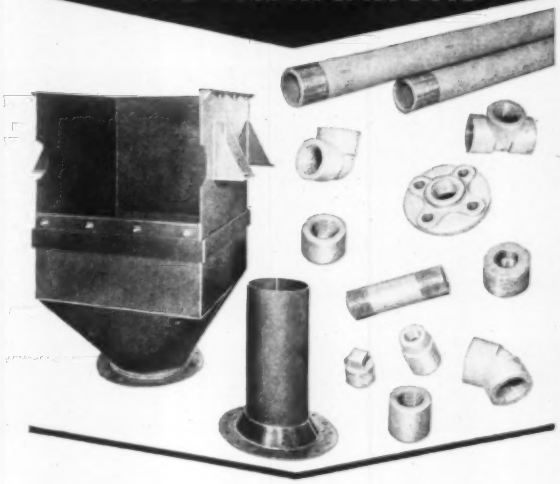
STOP Corrosion with...

Van-Cor

PLASTIC PIPE, FITTINGS AND FABRICATIONS



★ *Both Chemically Resistant and Impact Resistant Types*

★ *Half the Weight of Aluminum, with High Tensile Strength*

★ *Readily Formed, Machined, Drawn, Molded or Welded*

AVAILABLE FORMS

SHEETS... 1/32" through 1". PIPE... 1/2" through 8" diameter (10 or 20 ft. lengths). ROUND BARS... 1/8" through 5" diameter (10 ft. lengths). WELDING ROD... 1/8" and 5/32" diameter.

TYPICAL APPLICATIONS

A rigid non-plasticized polyvinyl chloride, Van-Cor is fabricated into such products as: Ducts, Hoods, Chemical Tanks, Tank Liners, Plating Racks, Fume Stacks and Piping.

WRITE FOR ILLUSTRATED BULLETIN, SPECIFICATIONS, AND NAME OF NEAREST DISTRIBUTOR

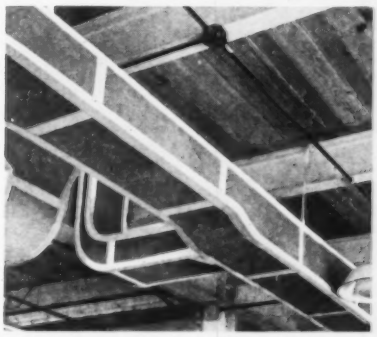
INDUSTRIAL DIVISION OF
COLONIAL PLASTICS MFG. CO.
SUBSIDIARY OF THE VAN DORN IRON WORKS CO.
2685 EAST 79th STREET • CLEVELAND 4, OHIO

COSTS MORE and WORTH IT!

Grant Wilson

DUX-SULATION

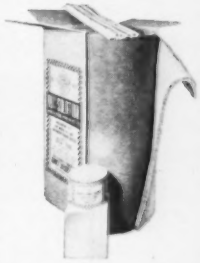
ASBESTOS PROTECTED



Despite the advent of many lower priced insulations, many of the nation's leading architects and engineers continue to specify Grant Wilson Dux-Sulation. One reason is that Dux-Sulation is just about indestructible — can't possibly be crushed or cracked. Its insulation and sound absorption efficiency, high to start with, *cannot* be impaired during installation.

Dux-Sulation can't powder, shift or sift. There are no "thin" spots, even at corners. There is no deterioration of any kind, no change of any kind. Insulating values are constant, indefinitely!

Special adhesive and tape (supplied) obviate the need for any additional "fasteners". If desired, Dux-Sulation can be applied in the shop and still withstand all necessary handling. On all counts, especially on projects where nothing less than the best is acceptable, Dux-Sulation is still your logical choice — the insulation you can specify with *absolute confidence* . . . no ifs, ands or buts!



write for Bulletin 567H-9

Grant Wilson inc.
ASBESTOS and INSULATING MATERIALS
141 WEST JACKSON BLVD. • CHICAGO 4, ILLINOIS

TUTTLE & BAILEY Imported

"the following equipment is recommended for testing

AEROFUSE DIFFUSERS...

Alnor VELOMETER"

That's the recommendation of Tuttle & Bailey for measuring *actual* air delivery of their diffusers—precisely and quickly in the field.

They know from their own tests—in their own complete laboratory—that a few simple readings with a Velometer equipped with a 2230 jet minimizes the time-consuming job of balancing out a system on installation.

The Velometer is the *only* instantaneous, direct-reading air velocity meter—accurate in all ranges, from high to low—compact, portable, easy to understand and use. Wide assortment of jets and fittings makes this precision instrument ideally suited for all air velocity measurement.

Get an Alnor Velometer for your air measurement needs. You'll save time and money wasted in balancing air distribution on your *next* job. If you'd like a copy of Tuttle & Bailey instructions on balancing Aerofuse Diffusers with the Velometer, just send the coupon below.

ILLINOIS TESTING LABORATORIES, INC.
Room 513, 420 N. LaSalle St., Chicago 10, Illinois
☐ Send Tuttle & Bailey Instructions
☐ Send Velometer Bulletin 2448-G

Name.....

Company.....

Address.....

City.....*State*.....

Alnor ILLINOIS TESTING LABORATORIES, INC.
PRECISION INSTRUMENTS FOR EVERY INDUSTRY

PYROMETERS • VELOMETERS • DEW POINTERS • PYROCONS
PYRO LANCES • THERMO-ANEMOMETERS • CONTROLLERS

WE HEAR THAT

Continued

▸ A triple tie was the outcome of a unique "Case the Space" contest conducted by *CARRIER CORP.* at the 48th annual convention of the *NATIONAL ASSOCIATION OF BUILDING OWNERS AND MANAGERS* in Cincinnati. The three topped 400 other owners and managers by correctly estimating the amount of rentable office space in square feet represented in an exhibit depicting 136 skyscrapers air conditioned by Carrier. The company awarded ¾ hp room air conditioners to the winners.

▸ Manufacture and shipment of 102 large forced air space heaters in 17 days has established a new heater production record for *DRAVO CORP.* The heaters will be used in Arctic areas to maintain livable temperatures in buildings for the U. S.-Canadian radar network system.

▸ *SQUARE D CO.* is beginning construction on a new plant at Royal Oak, Mich., and has started production at two recently completed units at Cedar Rapids, Ia. and Secaucus, N.J.

▸ *WOLVERINE TUBE DIV. OF CALUMET & HECLA INC.* has opened new general sales offices in the Guardian Bldg., Detroit.

▸ *GENERAL CONTROLS CO.* has opened expanded sales, warehousing and service facilities for its Cleveland regional activities in the form of a new two story building.

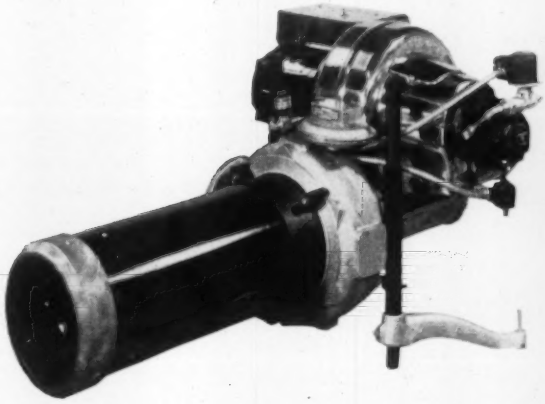
▸ Sales headquarters of the packing division of *RAYBESTOS-MANHATTAN, INC.* has been moved from Manheim, Pa. to Passaic, N. J.

▸ *COMBUSTIONEER DIV., THE STEEL PRODUCTS ENGINEERING CO.* recently held a four day sales meeting with district managers from all over the country in attendance.

▸ What is said to be the largest gas meter repair center in the Southeast has been opened by *ROCKWELL MFG. CO.* at Atlanta. The building, designed primarily for repair and servicing of gas equipment, will ultimately employ up to 60 persons.

▸ *Z. A. MARSH*, director of school activities for *MINNEAPOLIS-HONEYWELL REGULATOR CO.*, will head up the newly formed *Joint Committee of Industry and Education on School Facilities for Instructional Purposes*. The committee, a 100 man planning group of educators, state superintendents of public instruction, school architects and industrial representatives, will endeavor to focus national attention on the need for school room facilities that permit proper use of modern teaching materials.

Webster's New



CYCLONETIC*

DUAL FUEL BURNER

The Webster Cyclonetic* represents another step in the continuous effort of the Webster Engineering Company to provide the industry with carefully designed and tested combustion equipment, capable of satisfying the requirements of those who demand the ultimate in quality and service.

The development of the Cyclonetic* introduces a unique method of accomplishing flame retention and stability of a gas flame in a gun-type burner with no sacrifice of efficiency or safety when firing either gas or oil.

The Webster Cyclonetic* Dual Fuel Burner is designed to operate on either gas or light oil with only the flick of a switch necessary to change from one fuel to another. Employing 100% forced draft, the Cyclonetic* provides fully automatic operation on both fuels, with complete programming and safety built in.

Quiet-Dependable • Fully Equipped

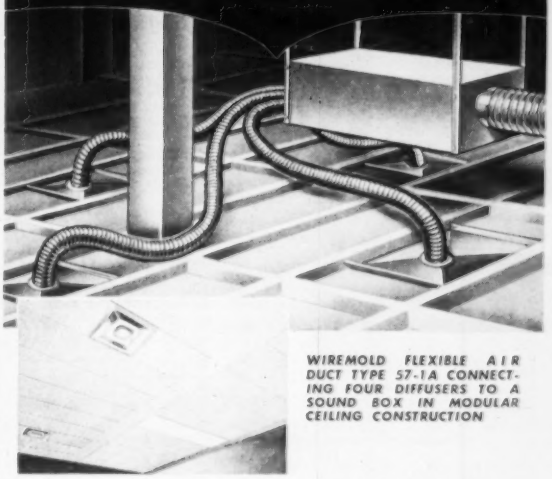
*TRADEMARK

Write for Literature

The WEBSTER ENGINEERING COMPANY
TULSA, OKLAHOMA
Division of SURFACE COMBUSTION CORPORATION, Toledo, Ohio

the FINAL ANSWER
for air conditioning in modular ceilings...

WIREMOLD FLEXIBLE AIR DUCT



WIREMOLD FLEXIBLE AIR DUCT TYPE 57-1A CONNECTING FOUR DIFFUSERS TO A SOUND BOX IN MODULAR CEILING CONSTRUCTION

WIREMOLD FLEXIBLE AIR DUCT can be used with modular acoustical ceilings to relocate diffusers without moving permanent duct work. Air distribution can be rearranged to meet changes in floor layout and partitioning. Flexible sections are also used as vibration dampers between branch ducts and sound boxes. (See extreme right above).

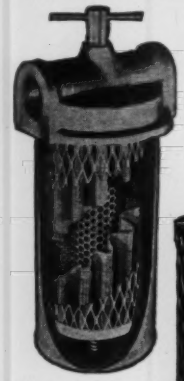
AIR DUCT'S EXTREME FLEXIBILITY allows wide offsetting in connecting air diffusers with branch ducts. Air Duct saves time and money on installation, *and* continues to save on maintenance costs every time a diffuser is relocated. With flexible Air Duct maintenance crews make changes easily and quickly.

AIR DUCT IS THE IDEAL SOLUTION to ducting problems in cramped quarters. Lightweight, sturdy, it takes sharp bends easily, greatly reduces installation time. New installations or remodeling projects become easier for architect and contractor when Wiremold flexible Air Duct is used for connections.

For complete information, write for Data Sheet S-5

The WIREMOLD Company
Hartford 10, Connecticut

WATER FILTERS



All of the outstanding qualities that have made MARVEL SYNCLINAL FILTERS the overwhelming choice in the filtration of hydraulic oils and other oil base liquids have been adapted to provide the same efficiency in the filtration of water.

Balanced Synclinal Design means longer periods of efficient filtration and productive operation.

STURDY CONSTRUCTION

to withstand use under rugged conditions, yet simple enough to allow any workman to easily disassemble, clean and reassemble on the spot, in a matter of minutes.

A SIZE FOR EVERY NEED

Available in line and sump type units in capacities from 5 to 100 G.P.M. Permanent type Monel metal insert ranging in mesh sizes from coarse 30 to fine 200.

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IMMEDIATE DELIVERY!

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MEETINGS & CONVENTIONS

SEPT. 6-16—*Production Engineering Show.* Navy Pier, Chicago. Concurrent with the *Machine Tool Show* at the International Ampitheater in that city. Registration: Clapp & Poliak, Inc., 341 Madison Ave., New York 17.

SEPT. 12-16—*Instrument Society of America,* 10th annual conference and exhibit. Shrine Exposition Hall and Auditorium, Los Angeles. The Society's maintenance clinic will precede on September 10-12. Show office: 3443 S. Hill St., Los Angeles 7.

SEPT. 12-16—*Corrosion Short Course.* Washington Univ., St. Louis. Sponsored by: National Association of Corrosion Engineers, 1061 M & M Bldg., Houston 2.

SEPT. 25-29—*American Society of Mechanical Engineers,* annual meeting. Roosevelt Hotel, New Orleans. ASME headquarters: 29 W. 39th St., New York.

SEPT. 26-30—*Trade Fair of the Atomic Industry.* Sheraton-Park Hotel, Washington, D.C. Sponsor: Atomic Industrial Forum, Inc., 260 Madison Ave., New York 16.

OCT. 17-19—*American Gas Association and Pacific Coast Gas Association,* 1955 convention. Statler Hotel, Los Angeles. AGA headquarters: 420 Lexington Ave., New York 17.

OCT. 17-21—*43rd National Safety Congress and Exposition.* Conrad Hilton, Congress, Morrison and La Salle Hotels, Chicago. Information: R.L. Forney, general secretary, National Safety Council, 425 N. Michigan Ave., Chicago 11.

OCT. 18-21—*National Association of Corrosion Engineers,* 1955 South Central region meeting. Hilton-Shamrock Hotel, Houston. NACE headquarters: 1061 M & M Bldg., Houston 2.

OCT. 19-21—*AIME-ASME Joint Solid Fuels Conference.* Neil House, Columbus, Ohio. Cosponsored by the American Institute of Mining and Metallurgical Engineers and the American Society of Mechanical Engineers. The latter is located at 29 W. 39th St., New York 18.

OCT. 20-21—*Sixth Annual National Noise Abatement Symposium.* Armour Research Foundation of Illinois Institute of Technology, Chicago. The Foundation is at 35 W. 33rd St., Chicago 16.

OCT. 24-26—*American Standards Association,* annual meeting. Sheraton Park Hotel, Washington, D. C. ASA headquarters: 70 E. 45th St., New York 17.

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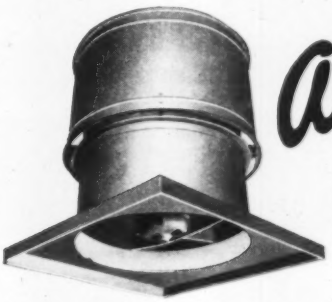

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Write for catalog on complete line of roof ventilators.

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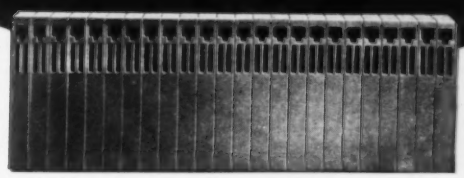
specify SHAW RADIATORS for perfect heating comfort



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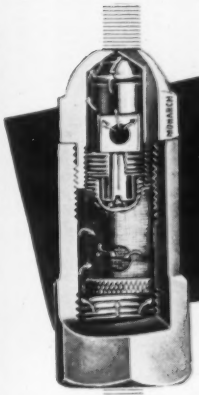

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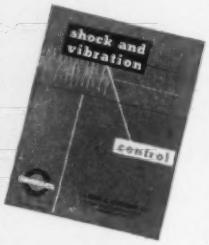

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MEETINGS & CONVENTIONS — *Continued*

OCT. 27-28.—*National Conference on Industrial Hydraulics*, 11th annual meeting. La Salle Hotel, Chicago. Sponsored by Illinois Institute of Technology and Armour Research Foundation, 35 W. 33rd St., Chicago 16.

NOV. 1-5—*World Symposium on Applied Solar Energy*. Westward Ho Hotel, Phoenix. Subjects to be discussed are space heating and cooling with solar energy, solar water heaters, mechanical energy from solar energy, direct conversion of solar energy and others. Symposium is cosponsored by the Association for Applied Solar Energy and Stanford Research Institute, Stanford, Calif.

NOV. 14-17—*2nd International Automation Exposition*. Navy Pier, Chicago. Exposition headquarters is at 845 Ridge Ave., Pittsburgh 12.

NOV. 14-18—*Chicago Exposition of Power & Mechanical Engineering*. Coliseum, Chicago. The exposition is being held in conjunction with the 75th Anniversary Meeting of the American Society of Mechanical Engineers. Management: International Exposition Co., Inc., 480 Lexington Ave., New York 17.

NOV. 27-29—*National Heating and Air Conditioning Wholesalers, Inc.*, national convention. Governor Clinton Hotel, New York. NHAW headquarters: 1200 W. Fifth Ave., Columbus 12, Ohio.

NOV. 28-*DEC.* 1—*9th Exposition of the Air Conditioning and Refrigeration Industry*. Auditorium, Atlantic City. The exposition is sponsored by the Air Conditioning and Refrigeration Institute, 1346 Connecticut Ave., N. W., Washington, D. C.

NOV. 30-*DEC.* 1—*National Warm Air Heating and Air Conditioning Association*, 42nd annual convention. Hotel Statler, New York. The Association is at 640 Engineers Bldg., Cleveland 14.

DEC. 1-3—*American Society of Refrigerating Engineers*, 51st annual meeting. Traymore Hotel, Atlantic City. R. C. Cross, secretary, 234 Fifth Ave., New York.

DEC. 5-9—*25th Exposition of Chemical Industries*. Commercial Museum and Convention Hall, Philadelphia. Management: International Exposition Co., 480 Lexington Ave., New York 17.

DEC. 10-17—*Nuclear Congress and Atomic Exposition*. Municipal Auditorium, Cleveland. American Institute of Chemical Engineers is the sponsor. Exposition director: Athel F. Denham, Atomic Exposition, 931 Book Bldg., Detroit 26. Concurrently will be held the *Nuclear Engineering and Science Congress*, De-

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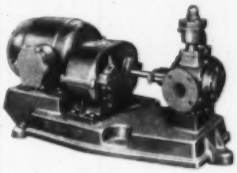

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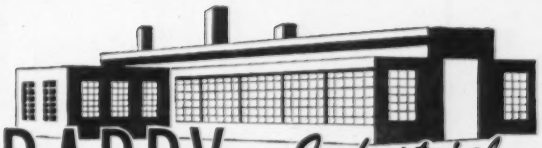

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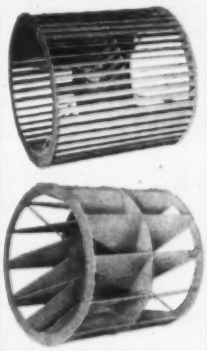

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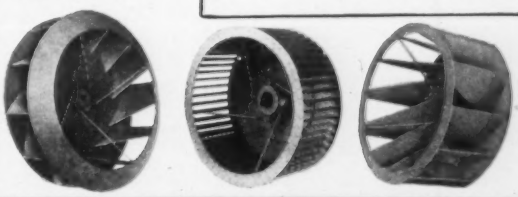

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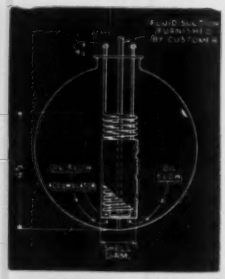

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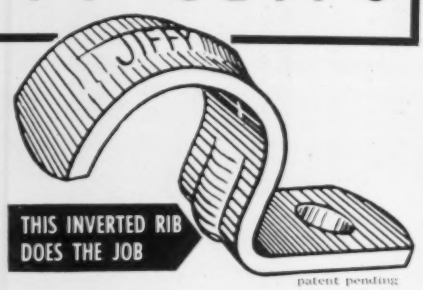

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MEETINGS & CONVENTIONS — *Continued*

cember 12-16. Engineers Joint Council, 29 W. 39th St., New York 18.

JAN. 23-25. *American Society of Heating & Air-Conditioning Engineers, Inc.*, annual meeting. Sheraton-Gibson Hotel, Cincinnati. ASHAE headquarters: 62 Worth St., New York 13.

FEB. 7-9—*11th Annual SPI Reinforced Plastics Division Conference.* Chalfonte-Haddon Hall, Atlantic City. Society of the Plastics Industry, Inc., 67 W. 44th St., New York 36.

MARCH 21-23—*18th Annual American Power Conference.* Hotel Sherman, Chicago. Sponsored by Illinois Institute of Technology, 35 W. 33rd St., Chicago 16.

JUNE 18-20—*American Society of Heating and Air-Conditioning Engineers, Inc.*, semi-annual meeting. Shoreham Hotel, Washington, D.C. ASHAE headquarters: 62 Worth St., New York 13.

FEB. 25-*MAR.* 1, 1957—*International Heating & Air-Conditioning Exposition.* International Ampitheater, Chicago. Under auspices of the American Society of Heating and Air-Conditioning Engineers. Management: International Exposition Co., 480 Lexington Ave., New York 17.

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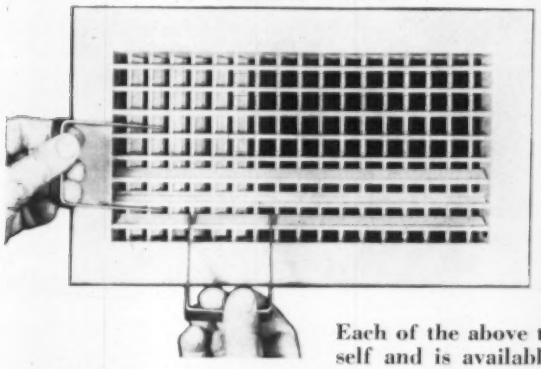
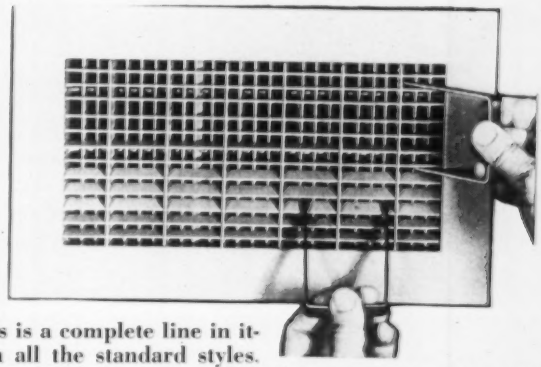


THE BAR TYPE



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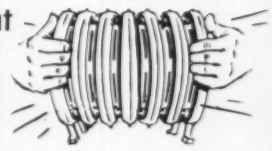

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ASTM STANDARDS IN BUILDING CODES—April 1955 Ed. 950 pp. Includes information on cast iron pressure pipe, gray iron castings for valves, flanges and pipe fittings, asbestos-cement pressure pipe, steel bolting and rivet material, steel pipe and tube, sheet and strip steel, welding electrodes and rods, thermal insulating materials. American Society for Testing Materials, 1916 Race St., Philadelphia 3.

PROCEEDINGS OF THE NATIONAL DISTRICT HEATING ASSOCIATION 44TH ANNUAL MEETING, 1953—251 pp. Copies from NDHA, 827 N. Euclid Ave., Pittsburgh 6. $10.00.

BRAZING MANUAL—Prepared by Committee on Brazing and Soldering, American Welding Society. 193 pp. Copies from AWS, 33 W. 39th St., New York 18. $4.75. ($3.80 to members.)

TECHNIQUES OF PLANT MAINTENANCE AND ENGINEERING, 1955—Proceedings of technical sessions held at Sixth National Plant Maintenance Show. 218 pp. Clapp & Poliak, Inc., 341 Madison Ave., New York 17. $7.50.

HANDBOOK OF ENGINEERING MATERIALS—Edited by Douglas F. Miner and John B. Seastone. 1382 pp. John Wiley & Sons, Inc., 440 Fourth Ave., New York 16. $17.50.

AN ANNOTATED BIBLIOGRAPHY ON NOISE, ITS MEASUREMENT, EFFECTS AND CONTROL—364 pp. Industrial Hygiene Foundation, Mellon Institute, 4400 Fifth Ave., Pittsburgh 13. $7.50.

ACCEPTANCE TEST PROCEDURE FOR WATER-COOLING TOWERS, mechanical draft, industrial type—CTI bulletin ATP-105. 8 pp. Cooling Tower Institute, 444 Emerson Ave., Palo Alto, Calif. 50c.

UNIVERSITY OF KENTUCKY HEAT PUMP NO. 1—By Estel B. Penrod, Merl Baker, Alfred M. Levy and Paul M. Chung. 84 pp. Bulletin No. 30 from Engineering Experiment Station, University of Kentucky, Lexington.

STRUCTURAL DESIGN DATA FOR APPLICATION OF CTI GRADES OF REDWOOD LUMBER IN WATER-COOLING TOWERS, mechanical draft, industrial type—CTI bulletin STD-102. 4 pp. Cooling Tower Institute, 444 Emerson Ave., Palo Alto, Calif. 25c.

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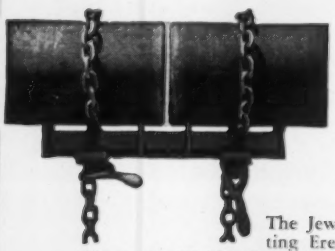

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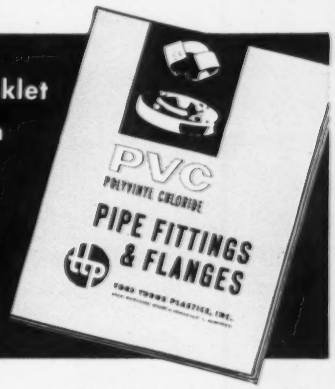

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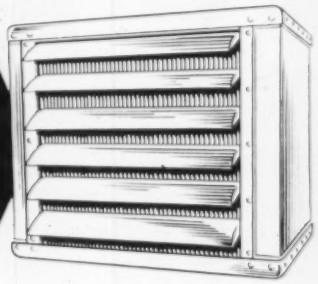

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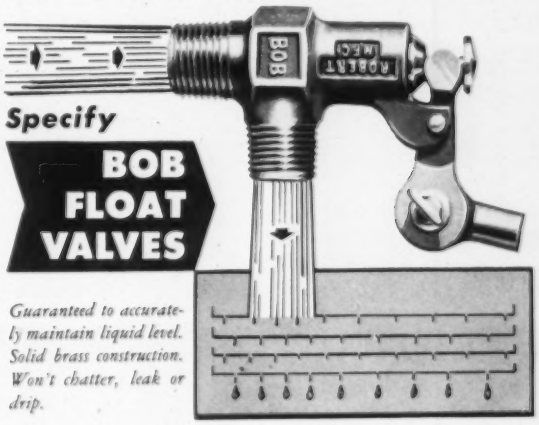

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NEW BOOKS & REPORTS

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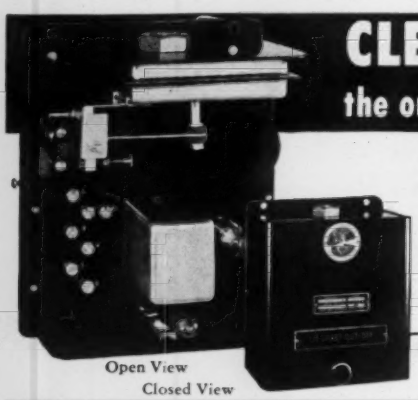
RING-JOINT GASKETS AND GROOVES FOR STEEL PIPE FLANGES, B16.20-1955—Revised Ed. American Standards Association, Inc., 70 E. 45th St., New York 17. $1.00.

CTI GRADES OF REDWOOD LUMBER FOR STRUCTURAL APPLICATIONS IN WATER-COOLING TOWERS, mechanical draft, industrial type—CTI bulletin STD-101. 4 pp. Cooling Tower Institute, 444 Emerson Ave., Palo Alto, Calif. 25c.

DEVELOPMENTS IN THE SAMPLING OF AIR-BORNE DUST—By Theodore Hatch. 6 pp. Industrial Hygiene Foundation, Mellon Institute, 4400 Fifth Ave., Pittsburgh 13. Free.

COMPILATION OF CHEMICAL COMPOSITION AND RUPTURE STRENGTHS OF SUPER-STRENGTH ALLOYS—ASTM special technical publication No. 170. 8 pp. American Society for Testing Materials, 1916 Race St., Philadelphia 3. 75c.

EARTH HEAT PUMP RESEARCH, PART IV—By Estel B. Penrod and Paul L. Pfennigwerth. 96 pp. Bulletin No. 35 from Engineering Experiment Station, University of Kentucky, Lexington.



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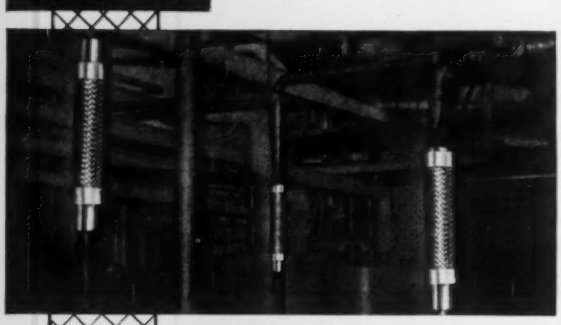

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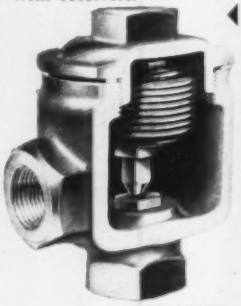

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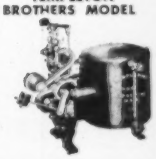

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patents . . .

INVENTORS AND MANUFACTURERS: Patentability Searches. Practice before the United States Patent Office. Invention Record and Patent Information Booklet free on request. Franklin W. Durgin, Registered Patent Agent. 410 Hill Building, Washington 6, D. C.

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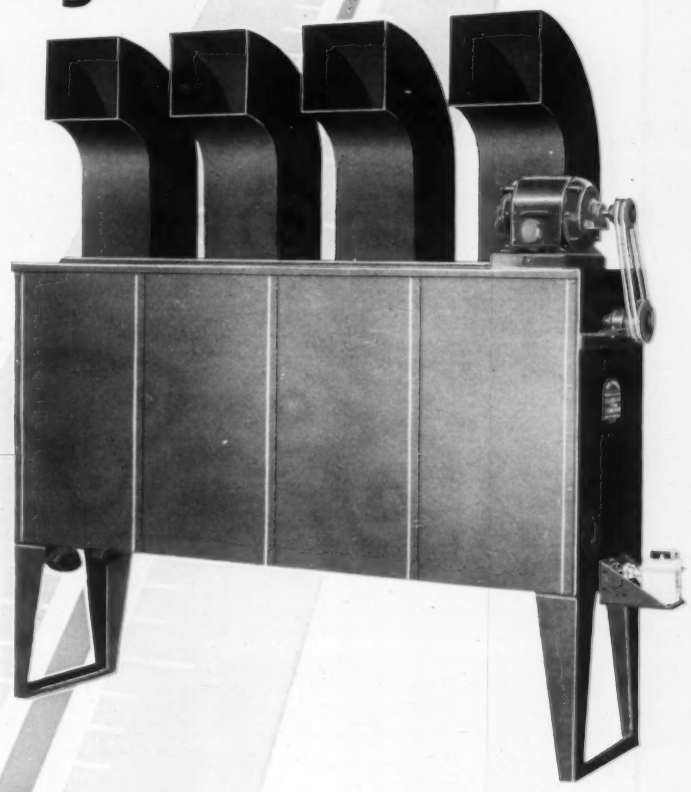

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